COMPLEXITY QUANTIFICATION IN WARFIGHTING SYMBOLOGY AND POTENTIAL MITIGATION MEASURES

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The most important role the commander plays in any Army unit, According to FM 6-0 Mission Command and Control of Army Forces, is that of combining the art of command with the science of control. This is accomplished through visualizing the battlespace, describing this visualization to subordinate leaders, directing actions to reach the intended end state, and leading subordinates to accomplish the given mission. One critical component of this visualization is the warfighting symbology promulgated in MIL-STD 2525. In this study, the complexity of these symbols will be investigated as well as the addition of mitigation measures to the process by which warfighting symbols are added to MIL-STD 2525.

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

COMPLEXITY QUANTIFICATION IN WARFIGHTING SYMBOLOGY AND POTENTIAL MITIGATION MEASURES, by Maj. Andrew D. Johnson, USMC, 130 pages.

The most important role the commander plays in any Army unit, According to FM 6-0 Mission Command and Control of Army Forces, is that of combining the art of command with the science of control. This is accomplished through visualizing the battlespace, describing this visualization to subordinate leaders, directing actions to reach the intended end state, and leading subordinates to accomplish the given mission. One critical component of this visualization is the warfighting symbology promulgated in MIL-STD 2525. In this study, the complexity of these symbols will be investigated as well as the addition of mitigation measures to the process by which warfighting symbols are added to MIL-STD 2525.

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ACRONYMS

AFRL	Air Force Research Laboratories
C2	Command and Control
CCB	Configuration Control Board
CM	Configuration Management
CP	Change Proposal
CPOF	Command Post of the Future
DISA	Defense Information Systems Agency
DRPR	Drawing Practices
FM	Field Manual
GIG	Global Information Grid
HFAC	Human Factors
ITS	Information Technology Management Standards
INST	Information Standards and Technology
JPG	Joint Photographic Experts Group
LSA	Lead Standardization Activity
MCEB	Military Communications Electronics Board
MCGT	Mapping, Charting, and Geodesy Technology
MDMP	Military Decision Making Process
MIL-STD	Military Standard
MOOTW	Military Operations Other Than War
NATO	North Atlantic Treaty Organization
NTDS	Navy Tactical Data System
SCC	Standards Coordinating Committee

SIDC	Symbol Identificatin Code
SSMC	Symbology Standards Management Committee
STANAG	Standardization Agreement
SVG	Scalable Vector Graphics
TRP	Technical Review Panel
XML	Extensible Markup Language

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CHAPTER 1

INTRODUCTION

Background and Context

The most important role the commander plays in any Army unit, According to Field Manual (FM) 6-0, *Mission Command and Control of Army Forces*, is that of combining the art of command with the science of control. This is accomplished through understanding the problem, visualizing the battlespace, describing this visualization to subordinate leaders, directing actions to reach the intended end state, and leading subordinates to accomplish the given mission (FM 6-0 2008, 3-1). This process is depicted below in figure 1.

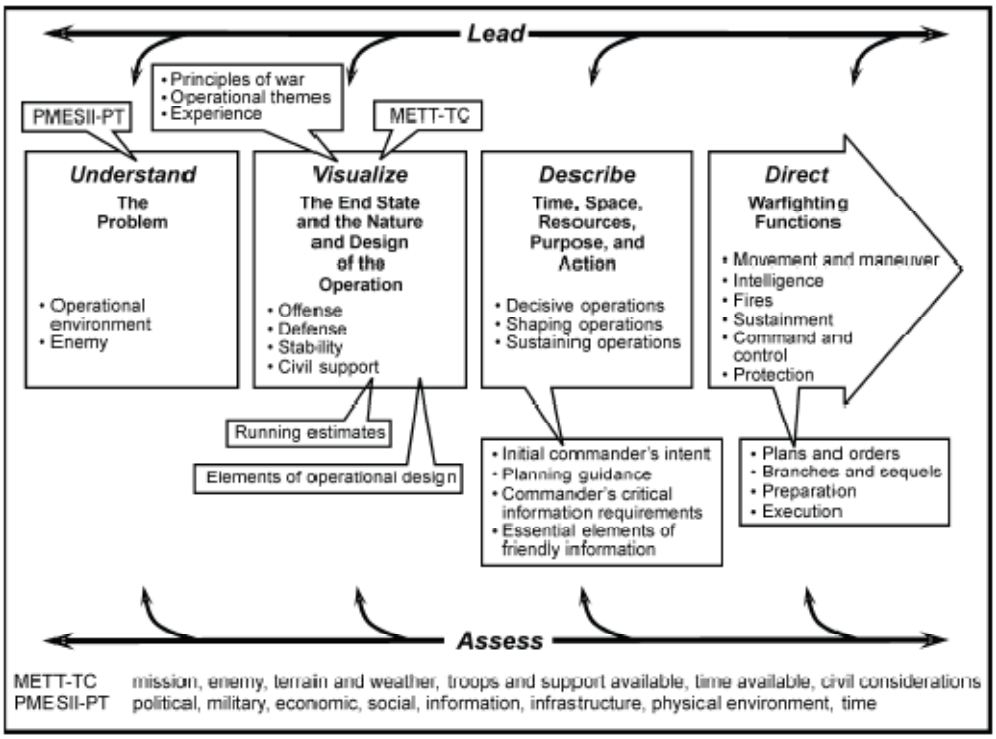


Figure 1. Battle Command Model

Source: U.S. Army, FM 3-0 *Operations* (Washington, DC: Government Printing Office, 2008), 5-3.

As figure 1 shows, a commander's exercise of command and control begins with his personal understanding of the problem followed by battlespace visualization, which serves as a point of departure for describing, directing, and leading as well as setting the foundation on which the Military Decision Making Process (MDMP) is built. Supporting battlespace visualization is the display information management activity, which FM 6-0 defines as "to represent relevant information in a usable, easily understood audio or visual form tailored to the needs of the user that conveys the common operational picture for decision making and exercising command and control functions." FM 6-0 also states that effective graphic displays show information clearly and understandably in an accurate, reliable, and timely manner in terms that subordinates understand (FM 6-0 2008, 3-16).

Visualization's importance to command and control in Army operations has been recognized and studied most recently in the Battle Command Battle Lab sponsored Cognition and Visualization study, which was part of the Army's Omni Fusion 2008 campaign. This study was conducted in order to identify the cognitive skills required to visualize full spectrum operations so as to inform the evolution of battle command doctrine and the development of future operators of command and control systems (TRAC 2008, 1). Results of this study indicated that for the prototypical operator of a command and control system, shared understanding of the mission space or problems begins with building situational awareness through a combination of human cognition and technology to answer questions needed to frame the mission space (TRAC 2008, 19). The report states that "once a vision of the mission space is formed in time, space, and

purpose, it must be unambiguously communicated to others and that this understanding is useless unless it can be shared with others" (TRAC 2008, 19).

Warfighting Symbology

The most important component of display and battlespace visualization is warfighting symbology, the use of which has evolved considerably since the first publication of FM 21-30 *Conventional Signs, Military Symbols, and Abbreviations* in 1941. After this manual's publication, revisions were published in 1943, 1951, 1961, 1965, and 1970, after which it was discontinued and replaced with FM 101-5-1 *Operational Terms and Symbols* in 1985. Since 1985, FM 101-5-1, now FM 1-02, has been periodically revised, with the most recent symbology relevant revision published in September 2004.

With the military changes inherent in the end of the Cold War, the development and increased implementation of data systems, as well as the call for standardization of warfighting symbology across the Department of Defense and with our NATO allies, MIL-STD 2525 was developed and the Defense Information Systems Agency (DISA) was designated the Executive Agent. The first iteration of MIL-STD 2525 appeared in September 1994 and was based on FM 101-5-1, STANAG 2019 *Military Symbols for Land Based Systems*, and STANAG 4420 *Display Symbology and Colours for NATO Maritime Units* (Repperger et al. 2006, 5-6). MIL-STD 2525 was followed by MIL-STD 2525A in 1996, MIL-STD 2525B in 1999, and MIL-STD 2525C in 2008.

With doctrinal changes and increased demand for information, each iteration of MIL-STD 2525 has grown in complexity. An Air Force Research Laboratories (AFRL) sponsored study in 2006 determined that some of the symbols contained in MIL-STD

2525B were potentially too complex, resulting in reduced effectiveness and information throughput (Repperger et al. 2006, 8). Considering these results, the constantly increasing complexity of the symbology set, the needs of the end user, and the limitations imposed by bandwidth, DISA's Global Information Grid (GIG) Enterprise Services Engineering Directorate, which is charged with management of MIL-STD 2525, has realized the need for fundamental cognitive research into symbol complexity and use. In a recent letter, Mr. Gerald Doyle, director of DISA's Global Information Grid Enterprise Services Engineering Directorate stated, "Due to this shift of information from large static maps to computer generated maps, logic dictates that studies are needed to determine if and how this change has impacted end users. It is believed that going from a large static map to a computer generated map on varying abilities across different domains could create confusion depending on how a symbol is generated [the transition from large paper maps with hand drawn symbology to computer generated maps and symbology could create confusion in the commander's visualization]" (Doyle 2008).

In this thesis, the complexity of warfighting symbology in MIL-STD 2525 as well as the process by which symbols are selected and approved for inclusion in each iteration of MIL-STD 2525 will be examined. This research will be conducted in order to determine the degree to which the increasing complexity of both the individual symbols and the symbol set as a whole is addressed. This study will further explore some potential methods by which these complexities may be addressed.

Primary and Secondary Research Questions

The primary research question to be answered in this study is: "Can the complexity of warfighting symbology as promulgated in MIL-STD 2525 be objectively

quantified and mitigated to allow commanders to communicate their battlespace visualizations more effectively?" Secondary questions are:

1. Based on military and commercial human factors research, what specific characteristics constitute complexity in warfighting symbology?

2. Using specific factors that constitute complexity in warfighting symbology, how complex are the Military Operations Other than War (MOOTW) symbols that have been added to MIL-STD 2525 in 2006 and 2007?

3. How could warfighting symbology complexity be addressed in the processes used to update MIL-STD 2525?"

Definitions

Following is a short glossary of terms used in this study, the understanding of which will aid the reader in understanding the topic and techniques used.

Fields. A defined area in which a limited combination of alphanumeric and other characters, indicators, and/or abbreviations are grouped/situated in an established way around a symbol/icon, line, area, point, or boundary and used for the purpose of providing additional information about the associated object or operational environment geometry (DISA 2008, 8)

Frame. The geometric border of a symbol that provides an indication of the standard identity, battle dimension, and status of a warfighting object (DISA 2008, 8).

Icon. The innermost part of a symbol that provides a graphic representation of a warfighting object (DISA 2008, 8).

Modifier. Optional text or graphics that provide additional information about a symbol or tactical graphic (DISA 2008, 9).

Symbol. An object that presents information (DISA 2008, 10).

Tactical graphic. A category of warfighting symbology that provides information about objects necessary for battlefield planning and management (DISA 2008, 10).

Tactical symbol. A category of warfighting symbology that provides information about the standard identity, battle dimension, status, and mission of a warfighting object (DISA 2008, 10).

Text. Words, alphanumeric information, and other ASCII characters used to define or further designate the meaning of a symbol (DISA 2008, 10).

Warfighting symbology. Symbology used to plan and execute military operations in support of C2 functions. These symbols fall into two basic categories: tactical symbols and tactical graphics (DISA 2008, 11).

Assumptions

Since this study is concerned with warfighting symbology complexity and not with the contributions of culture, cognitive psychology, or experience to symbol interpretation, the contributions of context and the viewer to meaning will be assumed to be constant.

Limitations

Where possible, this study will draw on the collective expertise of the U.S. Army and Defense Information Systems Agency.

Delimitations

Due to time constraints, development of survey instruments and methods of employment and analysis for the human factors relevant validation of methods for

addressing warfighting symbol and warfighting symbol set complexity will not be possible. Furthermore, this study will examine only computer generated symbols from the MIL-STD 2525B symbol set, exclusive of operational graphics and control measures, and not the Naval Tactical Data System (NTDS) symbol set in use by the U.S. Navy and U.S. Air Force.

Significance

Addressing the complexity of both the individual symbols and the symbol set as a whole will contribute to the ability to convey meaning and could potentially reduce errors in planning and execution when data systems such as Command Post of the Future (CPOF) are used.

CHAPTER 2

LITERATURE REVIEW

Introduction

The commander's visualization of the battlespace is an abstraction of the battlespace that provides subordinate leaders the information they need for the planning and conduct of operations. As in civilian cartography, the success of the commander's visualization depends on his skill as well as the ability of the subordinates to use that visualization properly (Nivala and Sarjakoski 2007, 276). When a subordinate receives the commander's visualization, he or she first detects that the product consists of a map with warfighting symbols and then is able to discriminate areal features, such as bodies of water or mountains, after which individual warfighting symbols are identified based on broadly distinguishing categories such as shape and color. Next, the user will recognize individual warfighting symbols and then, with this recognition, be able to interpret the commander's visualization (Nivala and Sarjakoski 2007, 276). In order to soundly interpret the commander's visualization, the user must have an understanding of the language in which it is written. That language is warfighting symbology.

Warfighting Symbology, Complexity, and Meaning

At the most fundamental level, symbology can be thought of as part of a system used for the conveyance of meaning. This system can be summarized by the following equation (Horton 1994, 22):

Symbol + Context + Viewer's Mind = Meaning

In the case of warfighting symbology, the symbol portion is the computer generated or hand drawn product, the context portion of this system is doctrine, the viewer is the end user, and the meaning is the warfighting symbol's overall usefulness and relevance. According to a 2003 study, point symbols, such as military unit or equipment symbols, are more difficult for users to process effectively than are area symbols such as bodies of water or urban terrain (Lloyd and Bunch 2003, 828). Results such as these indicate that the study of symbol complexity is important in order to determine the optimal ways in which to convey meaning. Since maps with warfighting symbology are read synoptically, the user's perception of each symbol is affected by the symbol's relationships with other map symbols (Nivala and Sarjakoski 2007, 276). Because of this, the complexity of an individual warfighting symbol can influence the user's ability to derive meaning from all others on the map.

Warfighting Symbol Components and Construction

In order to understand warfighting symbol complexity, it is important to first understand how symbols are constructed. As figure 2 shows, there are six basic components to a unit symbol, as promulgated in FM 1-02. The frame is the foundation of the symbol and represents affiliation, dimension, and status. Affiliation refers to the symbol being friendly, enemy, neutral, or among the others depicted in figure 4. Dimension refers to the symbol's operating environment, be it land, sea, air, or space. Status, shown in figure 5, refers to the unit being present at a location, planned, or suspected. Color is used to indicate affiliation, with cyan indicating friendly units, red indicating enemy units, green indicating neutral units, and yellow indicating units of unknown affiliation (FM 1-02 2004, 4-4). The icon, found in the center of the symbol,

identifies the type of the unit. In the case of figure 2, the icon is a cannonball, designating the unit as an artillery unit. The graphic modifier, as shown in figure 2, is used to indicate the unit's echelon. Specific graphic modifiers and their corresponding echelons are shown in figure 6. Finally, the text modifiers shown in figure 2 allow for additional specific information. In this example, the graphic modifier indicates that the unit is a battery level unit. The left most text modifier indicates that it is A battery and the right most text modifier indicates that this particular A battery is part of 6-37. Although unit symbols typically appear similar to figures 2 and 3, much additional information can be added, as shown in figure 7.

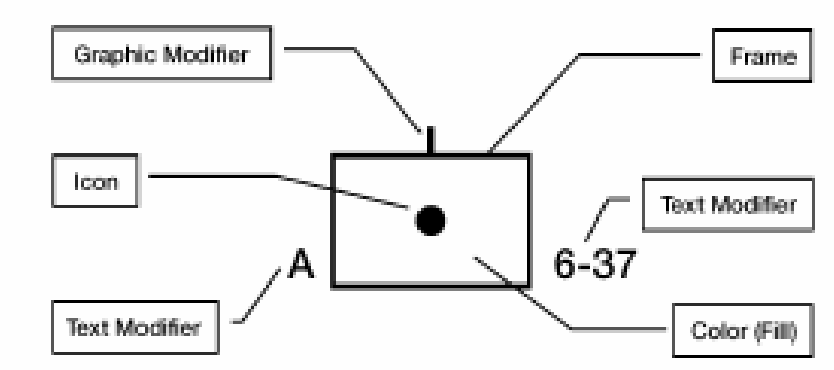


Figure 2. Friendly Artillery Unit Construction
Source: U.S. Army, FM 1-02 *Operational Terms and Graphics* (Washington, DC: Government Printing Office, 2004), 4-2.

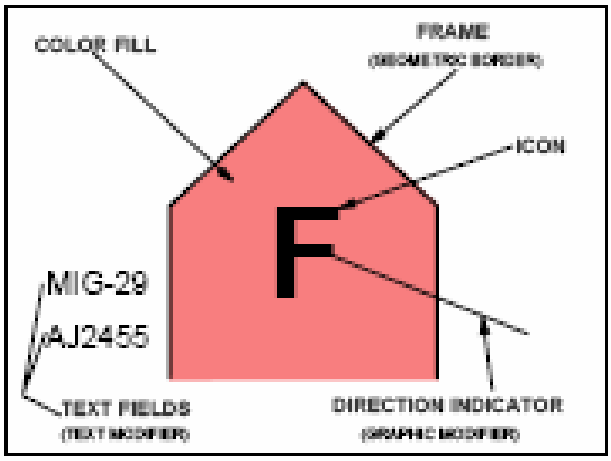


Figure 3. Enemy Air Platform Tactical Symbol Construction

Source: DISA, Draft MIL-STD 2525C *Department of Defense Interface Standard: Common Warfighting Symbology* (Washington, DC: Government Printing Office, 2008), 13.

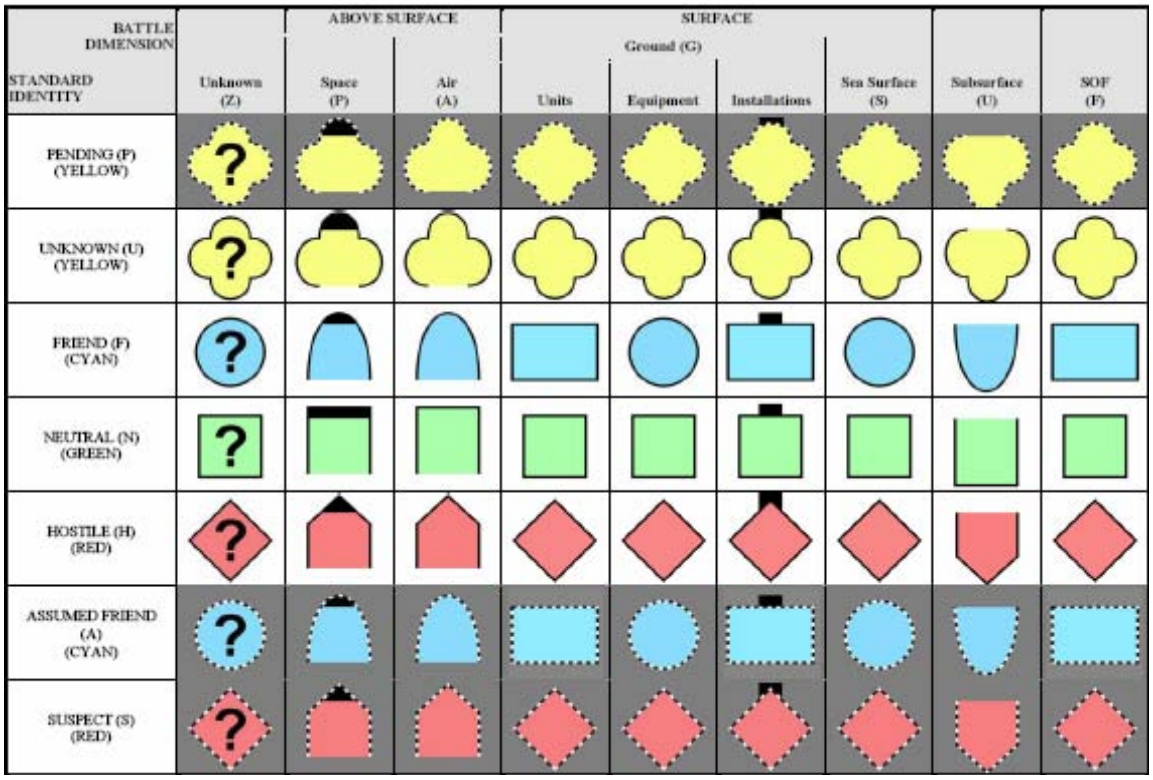


Figure 4. Frame Shapes, Dimensions, and Affiliations

Source: DISA, Draft MIL-STD 2525C *Department of Defense Interface Standard: Common Warfighting Symbology* (Washington, DC: Government Printing Office, 2008), 15.

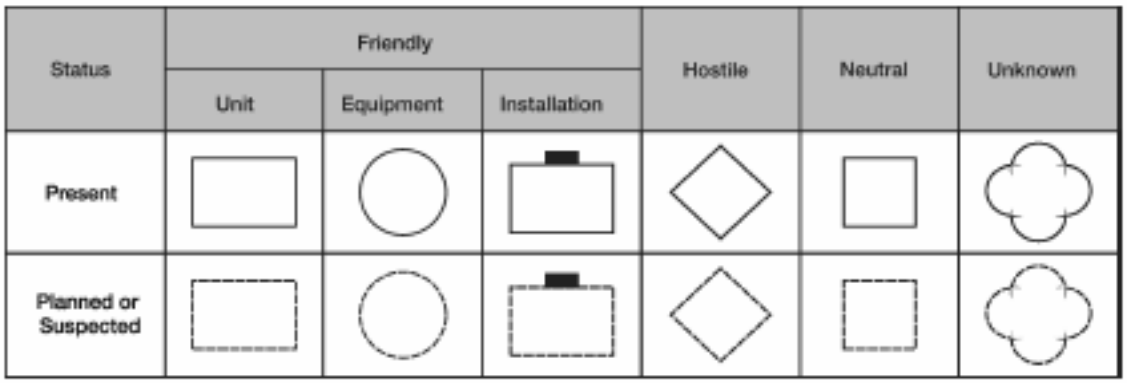


Figure 5. Frame Status

Source: U.S. Army, FM 1-02, *Operational Terms and Graphics* (Washington, DC: Government Printing Office, 2004), 4-4.

INDICATOR	DESCRIPTION
ø	TEAM/CREW
•	SQUAD
••	SECTION
•••	PLATOON/DETACHMENT
I	COMPANY/BATTERY/TROOP
II	BATTALION/SQUADRON
III	REGIMENT/GROUP
X	BRIGADE
XX	DIVISION
XXX	CORPS
XXXX	ARMY
XXXXX	ARMY GROUP/FRONT
XXXXXX	REGION
+ +	COMMAND[3]

Figure 6. Echelon Indicators

Source: DISA, Draft MIL-STD 2525C Department *of Defense Interface Standard: Common Warfighting Symbology* (Washington, DC: Government Printing Office, 2008), 25.

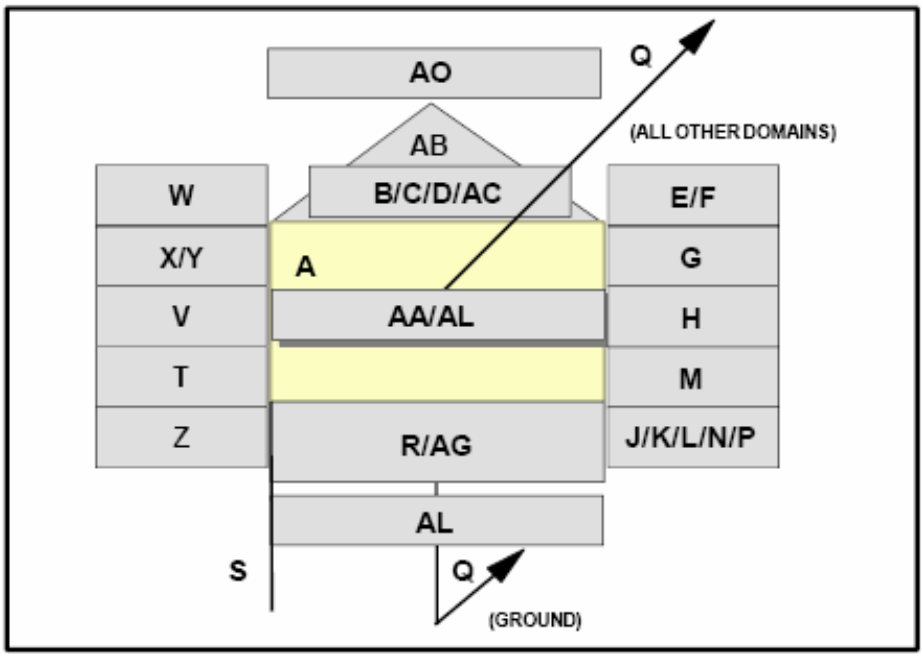


Figure 7. Tactical Symbol Field Positions

Source: DISA, Draft MIL-STD 2525C *Department of Defense Interface Standard: Common Warfighting Symbology* (Washington, DC: Government Printing Office, 2008), 21.

The specific steps for constructing a unit symbol are shown in figure 8. Generally speaking, the process begins with the selection of a frame for the symbol, after which the appropriate icon(s) are added, and concluding with the placement of graphic and text modifiers as needed.

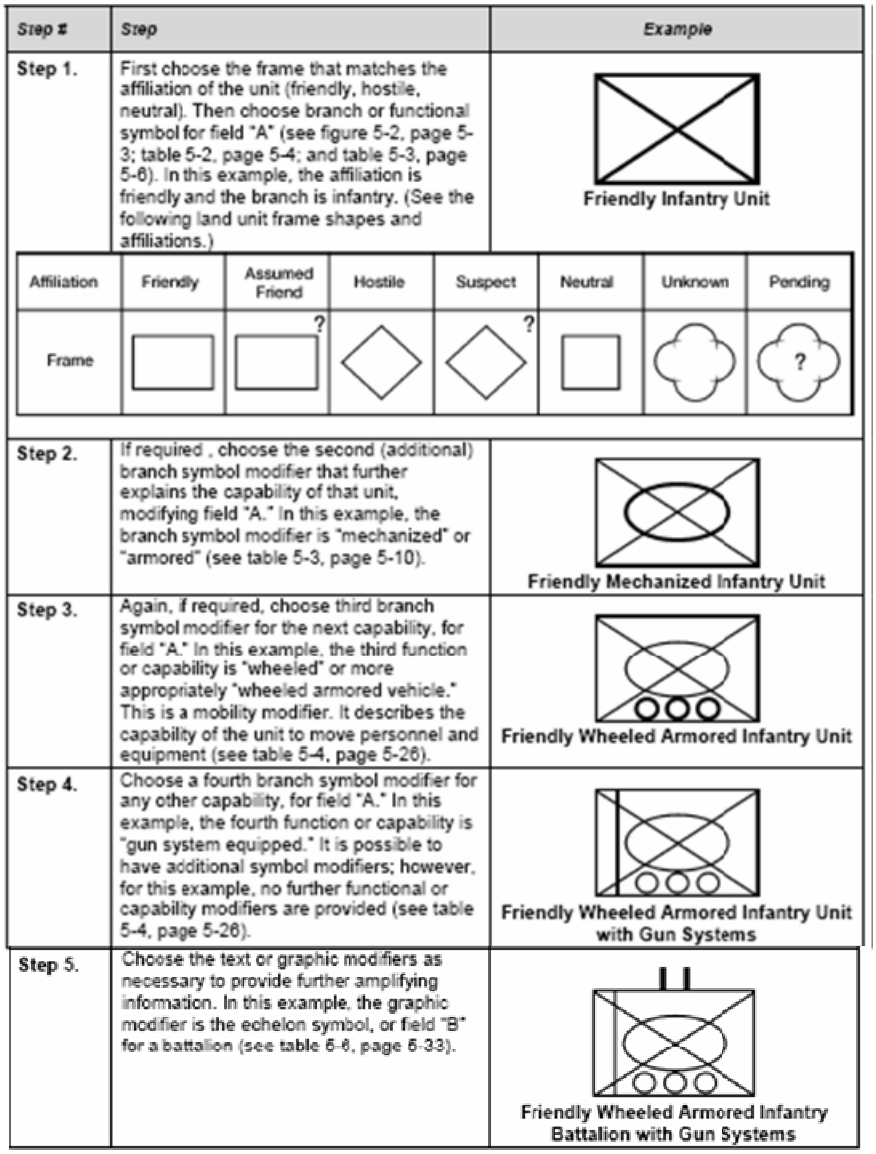


Figure 8. Unit Symbol Construction Process
Source: U.S. Army, FM 1-02 *Operational Terms and Graphics* (Washington, DC: Government Printing Office, 2004), 5-2.

Warfighting Symbology Complexity Parameters

Although there is a large volume of both military and civilian sponsored research into symbology, only limited military sponsored research has been conducted on the topic of symbol complexity. Although this research has resulted in many parameters of symbol

complexity, the current study will consider only those that can be easily measured in the context of warfighting symbology. These parameters include the number of elements, closure, continuity, number of lines in frame and icon, number of arcs, the presence of text, figural unity, symmetry, and distinctiveness.

In order to illustrate the parameters that several of these studies have discussed, each will be considered in the context of one relatively simple symbol and one relatively complex symbol, which are shown in figure 9. Both have the same type of frame and same color and differ only in their respective icon content. While the artillery unit has a single cannonball icon, the tactical satellite unit has the basic icon for a signal unit (the lightning bolt), and an additional icon representing a satellite.

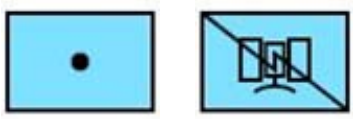


Figure 9. *Left*, Friendly Artillery Unit; *Right*, Tactical Satellite Unit
Source: MIL-STD 2525B (DISA Friendly artillery unit symbol sfgpucf 2007, Friendly tactical satellite unit symbol sfgpuusr 2007).

Simplicity, for the purposes of this study, will be a measure of the number of elements contained in a symbol. Generally speaking, 7 +/-2 elements is considered to be optimal. Recent research, however, suggests that more than 6 elements is ineffective (Repperger et al. 2006, 8). Both of the example symbols in figure 9 contain a frame, color, and at least one icon. The tactical satellite unit symbol, however, contains an additional icon representing a satellite which is composed of 3 rectangles, 1 arc, and 1

straight line. Thus, the artillery symbol has 3 elements while the tactical satellite unit symbol has 8.

When a shape such as a rectangle or circle has no gaps in its perimeter, that shape is said to have closure. Closure is desirable in warfighting symbology because there is a tendency for users to unconsciously distort symbols that lack closure in such a way that the parts that are assumed to be missing are "filled in", creating an illusion as in figure 10 (Kienle 1991, 12). With only a cannonball shaped icon in the middle of the frame, the artillery unit symbol shows closure. Although the tactical satellite unit symbol shown in figure 4 has an arc towards the bottom of the icon, it does show closure because the arc is not more than 180 degrees.

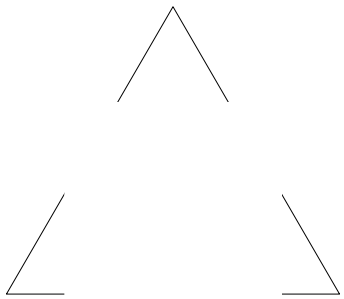


Figure 10. Triangle Lacking Closure
Source: Created by author.

Continuity is similar to closure, but does not lead the user to unconsciously provide information that is not present. A geometric figure has continuity when its perimeter is uninterrupted by an extension of the shape (Kienle 1991, 12), as shown in figure 11, or by intersection with external lines or shapes, as shown in figure 12. The

artillery unit symbol shown in figure 9 has continuity. In the tactical satellite unit symbol, however, the signal icon interrupts the boundaries of the three rectangular satellite icon components twice each, for a total of 6 breaches of continuity.

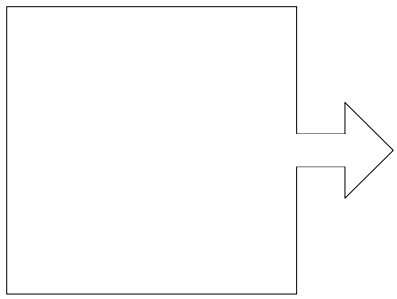


Figure 11. Square Lacking Continuity
Source: Created by author.

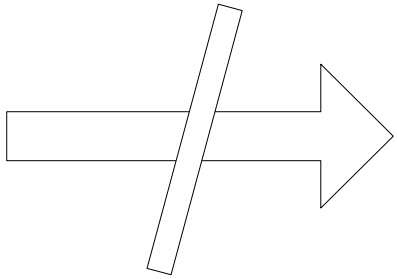


Figure 12. Arrow Lacking Continuity
Source: Created by author.

The number of lines that make up a warfighting symbol's frame has been shown to be indicative of that symbol's complexity, with more lines indicating greater complexity (Geiselman, Landee, and Christen 1985, 13). As figure 5 shows, there are numerous frame options in use, each of which conveys a specific meaning. In the

examples shown in figure 9, both symbols have the same rectangular frame consisting of four solid lines and are therefore of equal complexity in this parameter.

The number of lines that make up a warfighting symbol's icon has also been shown to be indicative of that symbol's complexity, with more lines indicating more complexity (Geiselman, Landee, and Christen 1985, 13). The artillery unit symbol in figure 9 contains no lines in its icon. The tactical satellite unit symbol, however, contains 16 lines (4 lines for each of the 3 rectangles, 3 lines for the signal icon, 1 line joining the arc at the bottom to the center rectangle) and is thus more complex in this parameter.

The number of arcs contained in both a warfighting symbol's frame and icon is another parameter indicative of its complexity, with a greater number of arcs corresponding to a higher level of complexity (Kienle 1991, 12-13); (Geiselman, Landee, and Christen 1985, 7). In the case of the examples in figure 9, the artillery unit symbol contains no arcs while the tactical satellite symbol contains a single arc. Therefore, in this parameter the latter is more complex.

The use of text in warfighting symbols has been shown in some research to improve accuracy in map reading tasks (Repperger et al. 2006, 15). This improved performance, however, adds additional elements to the warfighting symbol and thus increases its complexity while decreasing speed of use (Kienle 1991, 14). In the case of the examples in figure 9, neither unit symbol contains text. Therefore, they are equally complex in this parameter.

A warfighting symbol has absolute figural unity when there are no elements external to the frame (Geiselman, Landee, and Christen 1985, 5). Since figural unity is inversely related to complexity, a high degree of figural unity is desirable for an effective

symbol. In warfighting symbology, these external elements would be graphic and text modifiers. As figure 7 shows, there are 18 positions at which such modifiers can be added to a symbol. In the case of the unit symbols in figure 9, both have absolute figural unity and are therefore equally complex in this parameter.

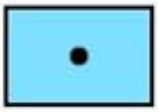
Symmetry is another parameter of warfighting symbol complexity, with asymmetric warfighting symbols being more complex than their symmetric counterparts (Geiselman, Landee, and Christen 1985, 5). In the case of the examples in figure 9, both are symmetric about the horizontal and vertical axes and are therefore equally complex in this parameter.

Distinctiveness, or discriminability, is a measure of a warfighting symbol's similarity, and therefore potential for confusion with, other warfighting symbols or map features. While it has been shown that a warfighting symbol's distinctiveness can be estimated based on an assessment of its elements (Geiselman, Landee, and Christen 1985, 2), such estimates should be taken in the context of the individual warfighting symbol's relationship to the entire warfighting symbol set (Geiselman, Landee, and Christen 1985, 27); Kienle 1991, 13). The measurement of distinctiveness, then, is accomplished by determination of elements shared between individual warfighting symbols or individual warfighting symbols and the complete warfighting symbol set. In the case of the examples in figure 9, the artillery unit symbol has 3 elements while the tactical satellite unit symbol has 8. Of these elements, only 2 are shared. Therefore these two warfighting symbols have a high degree of distinctiveness.

Based on the 10 parameters of warfighting symbology complexity described in the literature, an artillery unit symbol and a tactical satellite unit symbol have been

evaluated and have been found, as shown in table 1, to differ in their degrees of complexity and have a high degree of distinctiveness when compared. As doctrine evolves and more symbols are added to future iterations of MIL-STD 2525, there will be a need to maintain as high a degree of distinctiveness as possible. Maintaining this distinctiveness while increasing the number of warfighting symbols is likely to cause both the warfighting symbol set and the individual warfighting symbols to grow in complexity.

Table 1. Complexity Parameters for an Artillery Unit Symbol and a Tactical Satellite Unit Symbol

Parameter		
Simplicity	3	8
Closure	Yes	Yes
Continuity	Yes	No (6 interruptions)
Lines in frame	4	4
Lines in icon	0	16
Number of arcs	0	1
Alphanumeric characters	0	0
Figural unity	Yes	Yes
Symmetry	Yes	Yes
Distinctiveness	2 shared elements	2 shared elements

Source: Created by author.

Warfighting Symbology Management

The warfighting symbology promulgated in MIL-STD 2525 is used by all four Services, numerous DoD agencies, and allied nations. Because of its widespread use and the need for standardization, DoD established the management structure shown in figure 13. In this management structure, the Standards Coordinating Committee (SCC), under authority from the Military Communications Electronics Board (MCEB), manages the operation of the Symbology Standards Management Committee (SSMC). The SSMC acts as the Configuration Control Board (CCB) for warfighting symbology and coordinates with a Lead Standardization Activity (LSA), which is responsible for particular aspects of symbology standards management. These LSAs, who are under the management of the Assistant Secretary of Defense for Economic Security, include Mapping, Charting, and Geodesy Technology (MCGT), which is responsible for mapping, charting, and geodesy specific symbology; Drawing Practices (DRPR), which is responsible for engineering design symbology; Human Factors (HFAC),which is responsible for aircraft display symbology; and Information Standards and Technology (INST), which is responsible for warfighting symbology (DISA 1995, 2-2). These LSAs, their executive agents, and their relationship to the SSMC are illustrated in figure 14.

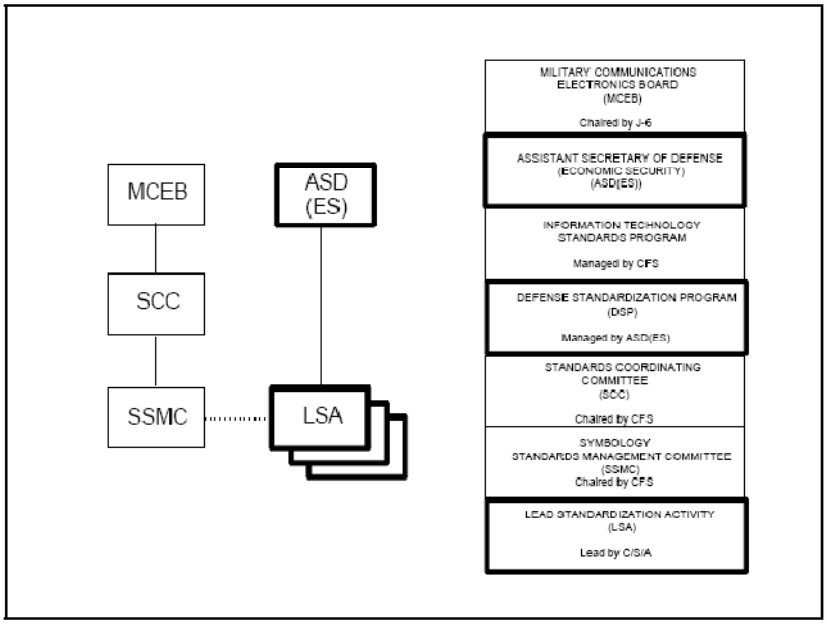


Figure 13. Symbology Information Technology Management Standards (ITS) Structure

Source: DISA Joint Interoperability and Engineering Organization, Symbology Information Technology Standards Management Plan (Washington, DC: DISA, 1 March 1995), 2-2.

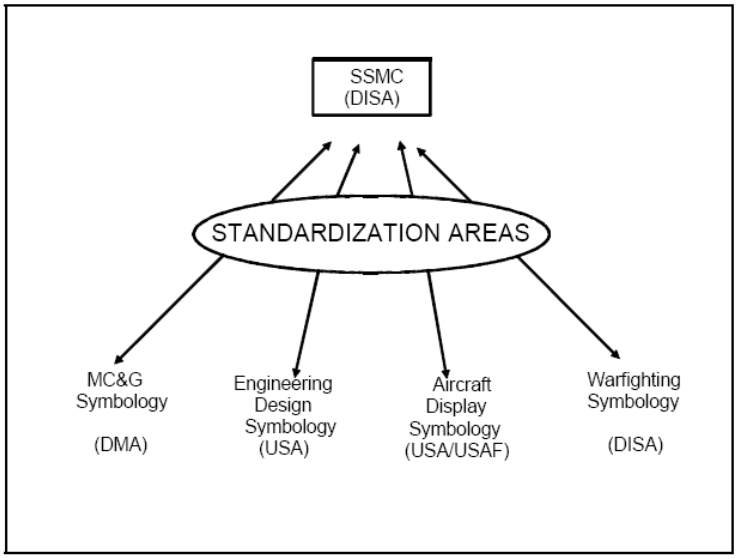


Figure 14. LSAs, Executive Agents, and Standardization Relationships

Source: DISA Joint Interoperability and Engineering Organization, Symbology Information Technology Standards Management Plan (Washington, DC: DISA, 1 March 1995), 2-3.

DISA established the Symbology Standards Management Committee (SSMC). One of the SSMC's primary tasks is to "Develop symbology standards selection criteria by combining operational requirements, human factors engineering, and technical considerations and serve as the primary coordination point for symbology ITS activities conducted within the DSP standardization areas" (DISA 2005, 6). The SSMC has the additional duties of managing warfighting symbology standards, maintaining the symbology web site, reviewing and updating symbology management documents annually, and reviewing and updating select standards bi-yearly (DISA 2005, 7).

The SSMC is co-chaired by members of the Joint Staff J6 and DISA's Systems Engineering, Architecture, and Integration Center, Standards Management Branch (GE332) (DISA 2005, 7). Voting members of the SSMC represent Combatant Commands, Services, and Agencies that use the symbology. They are designated in writing by their respective organizations and provide some degree of technical expertise to the maintenance of symbology standards (DISA 2005, 7). Voting members representing Services ensure that proposed symbol changes are appropriately linked to doctrine. The SSMC meets quarterly or more frequently if necessary to make decisions regarding change proposals, which are posted three weeks prior to the meeting. Change proposals are discussed and final decisions are made by consensus (DISA 2005, 8).

The Change Proposal Process

The change proposal process, shown in figure 15, begins when a Combatant Command, Service, or DoD agency identifies the need for a change to MIL-STD 2525 and submits a change proposal to their SSMC representative. If the SSMC representative finds that the change proposal addresses a valid deficiency in MIL-STD 2525, he or she

will forward the change proposal to the Configuration Management (CM) administrator, who ensures that the change proposal contains no administrative errors. At this point, the change proposal is reviewed for technical adequacy and potential impact on other programs. If the CM administrator determines that the change proposal warrants additional technical consideration, a Technical Review Panel (TRP) will be convened and testing will be conducted as required. The Configuration Control Board (CCB), a subset of the SSMC, then reviews the change proposal and makes it available to all SSMC members through the SSMC's website. Once the change proposal has been made available, all organizations have 30 days to review the change proposal for potential negative effects on their systems and to voice their concerns and positions to the SSMC through their SSMC representatives. The CCB then consolidates these concerns and positions and either makes a decision or reissues the change proposal if necessary. The decision is then published as a Final CP Decision Document. If there are no dissenting opinions, it is approved and incorporated into the updated MIL-STD 2525. If there are dissenting opinions, the CCB member will appeal the decision within 15 working days through the CCB chairman (DISA 1997, 8-13).

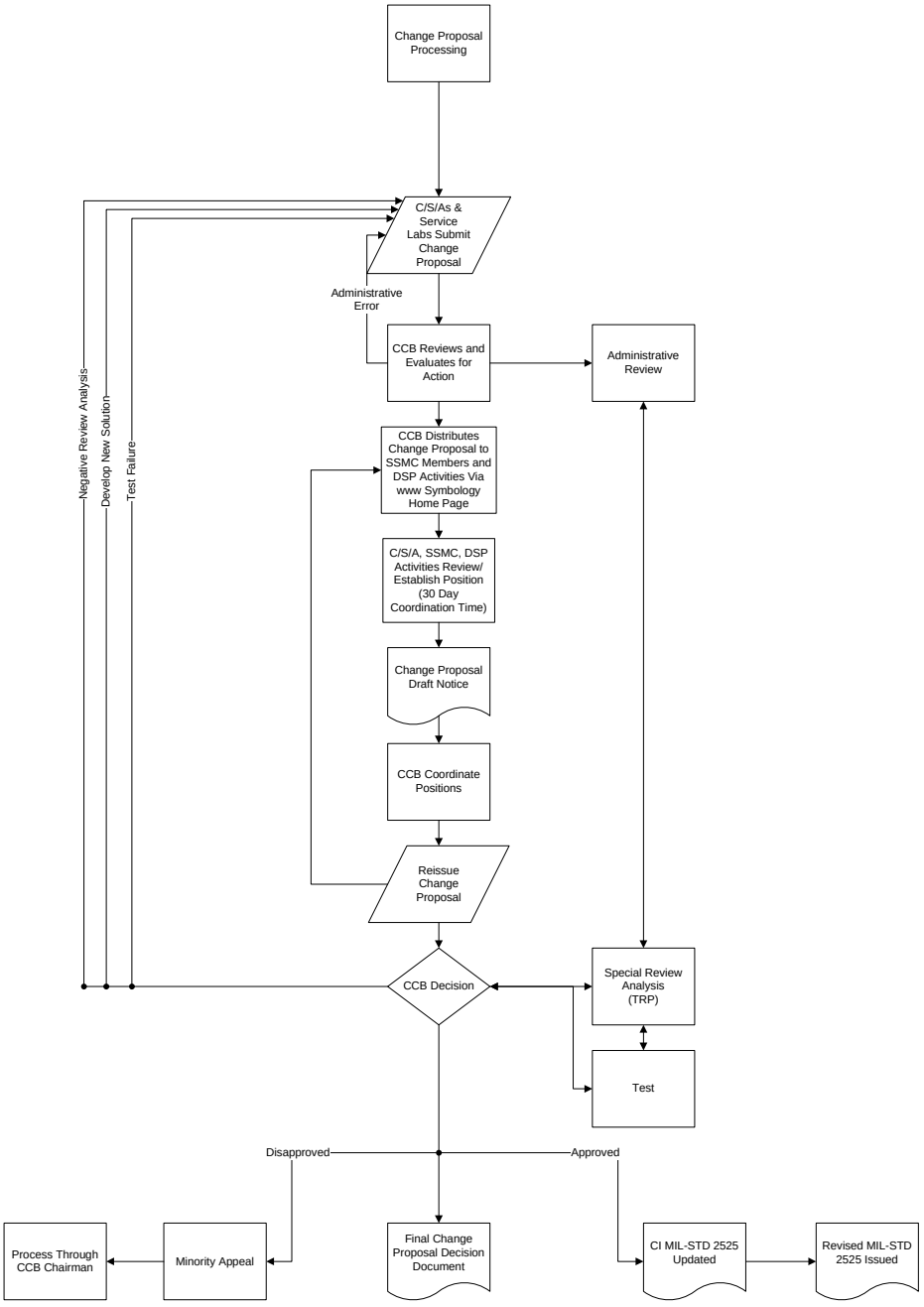


Figure 15. Change Proposal Process

Source: Adapted from DISA Joint Interoperability and Engineering Organization, Symbology Information Technology Standards Management Plan Supplement 1: Configuration Management. (Washington, DC: DISA, 1 May 1997), 10.

Human Factors Considerations for Warfighting Symbology

As discussed previously, both the DoD Symbology Information Technology Standards Plan and the SSMC Charter address the need to consider human factors in the management of warfighting symbology. The former states that the Human Factors LSA, managed by the U.S. Army and the U.S. Air Force, is responsible for aircraft display symbology. In the present management structure, however, there is no direct human factors consideration, to include complexity, given to warfighting symbology as promulgated in MIL-STD 2525. The latter states that the SSMC will use human factors engineering to assist in the development of symbology standards selection criteria. While such considerations are important in the development of symbology standards selection criteria, they are also important in the development of the symbols themselves. Since no human factors considerations are given to the development of symbols during the change proposal process, the SSMC has complied with its charter but has not considered the needs of the end user, the commander in the field, who has been provided with a symbology that has been thoroughly managed for compliance with standards and doctrine, but with no consideration given to human factors, such as complexity.

Conclusion

In summary, warfighting symbology has evolved with the doctrine it visually represents. As warfighting symbology has evolved, it has increased in complexity. With the increase in complexity comes the potential for misunderstanding of the commander's battlespace visualization among subordinates. Since the commander's battlespace visualization is the foundation upon which plans are built, such misunderstandings could lead to errors in planning and execution. The current process by which warfighting

symbols are added to MIL-STD 2525 is concerned primarily with ensuring compliance with standards and doctrinal applicability, but neglects such human factors aspects as complexity. While compliance with standards and doctrinal applicability are important from an administrative or configuration management perspective, the current process does not adequately address the needs of the end user, the commander in the field who needs to visualize the battlespace in order to exercise command and control.

CHAPTER 3

RESEARCH METHODOLOGY

Research Design Overview

Research will begin with an investigation of the factors shown to influence symbol complexity in both military and civilian sponsored research. The end product of this initial investigation will be a quantitative measure of symbol complexity, which will be based on the following factors described in symbology research:

1. Simplicity
2. Closure
3. Continuity
4. Number of lines in external shape
5. Number of lines in internal shape
6. Number of arcs
7. Number of alphanumeric characters
8. Figural unity
9. Symmetry

Complexity will be quantified for all MIL-STD 2525B symbols for ground combat, combat support, combat service support, and installations as well as for MOOTW symbols added in 2006 and 2007. The results of this complexity quantification will be compared for different categories of symbols within the ground combat, combat support, combat service support, and installation hierarchies.

Selection of Symbols for Evaluation

Warfighting symbols to be evaluated will be selected from the electronic version of MIL-STD 2525B, which is produced and distributed by DISA in .svg and .jpg format. The symbols evaluated from this study will be from the Ground Track and MOOTW portions of the electronic version of MIL-STD 2525B.

Complexity Evaluation

In order to make the data more manageable, spreadsheets will be structured following the taxonomy scheme in MIL-STD 2525B as shown in figure 16. For ground equipment and installations, one Microsoft Excel ® 2007spreadsheet file will be created with each subsequent taxonomic level shown in figure 16 comprising a worksheet within that spreadsheet. For ground units, one spreadsheet file will be created for combat, combat service support, and combat support. Special C2 headquarters will be included in the combat support spreadsheet as a separate worksheet. Separate worksheets will be made for each additional taxonomic level.

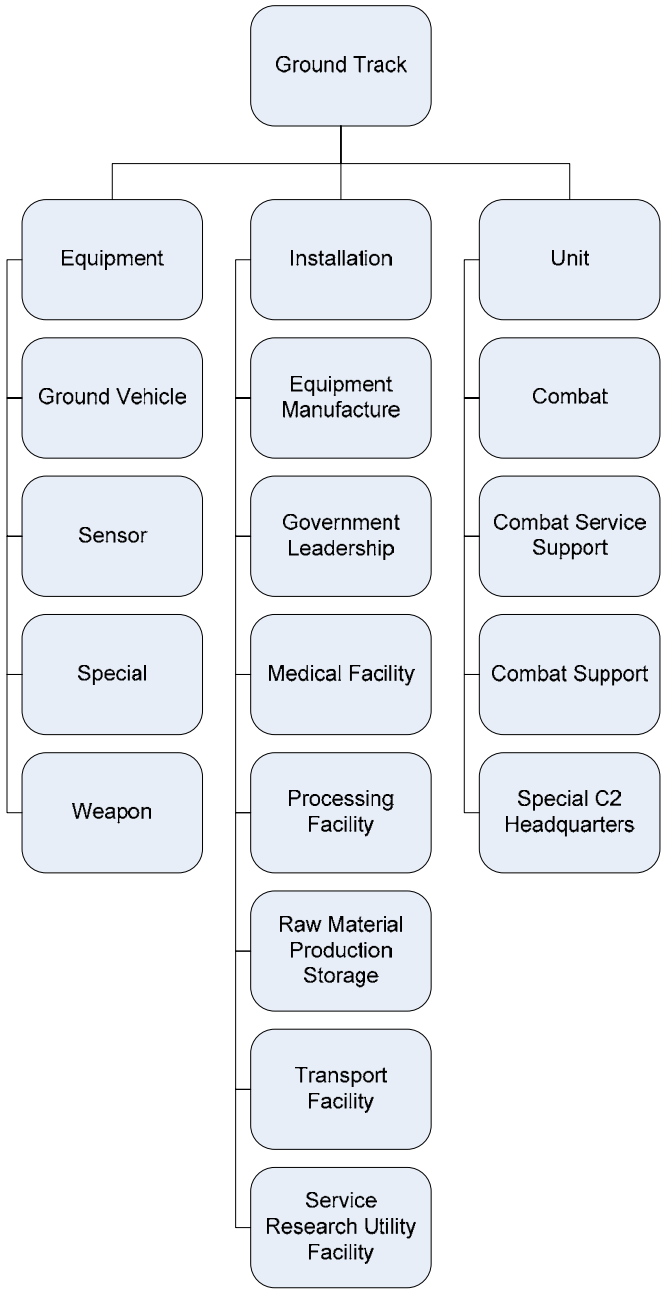


Figure 16. Ground Track Warfighting Symbology Taxonomy
Source: Adapted from MIL-STD 2525B 2007.

Field Artillery

Category	Subcategory 1	Subcategory 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alphanumerics	Figural Unity	Symmetry	Complexity Coefficient
				sfgpucf	3	0	0	0	0	0	0	0	3
Artillery Survey				sfgpucfs	6	0	0	2	0	0	0	2	10
Artillery Survey	Air Assault			sfgpucfss	8	0	0	4	0	0	0	2	14
Artillery Survey	Airborne			sfgpucfsa	8	0	0	2	2	0	0	2	14
Artillery Survey	Light			sfgpucfsl	7	0	0	2	0	1	0	2	12
Artillery Survey	Mountain			sfgpucfso	7	0	0	2	0	0	0	2	11
Howitzer Gun				sfgpucfh	3	0	0	0	0	0	0	0	3

Figure 17. Symbol Complexity Evaluation Spreadsheet
Source: Created by author.

Values for each of the 9 complexity parameters will be entered into the spreadsheet as shown in figure 17. The header, “Field Artillery” in figure 17, indicates the name of the worksheet within the spreadsheet. Column A indicates the category within Field Artillery. Columns B and C indicate subcategories within the category indicated in Column A. Column C is a graphic depiction of the symbol in .jpg format. Column D is the SIDC, or Symbol Identification Code, which is used to systematically identify each Warfighting symbol (figure 18).

CODING SCHEME (1) (POSITION 1)	AFFILIATION / EXERCISE AMPLIFYING DESCRIPTOR (1) (POSITION 2)	BATTLE DIMENSION (1) (POSITION 3)	STATUS (1) (POSITION 4)
S - WARFIGHTING	P - PENDING U - UNKNOWN A - ASSUMED FRIEND F - FRIEND N - NEUTRAL S - SUSPECT H - HOSTILE G - EXERCISE PENDING W - EXERCISE UNKNOWN M - EXERCISE ASSUMED FRIEND D - EXERCISE FRIEND L - EXERCISE NEUTRAL J - JOKER K - FAKER	P - SPACE A - AIR G - GROUND S - SEA SURFACE U - SEA SUBSURFACE F - SOF X - OTHER (No frame) Z - UNKNOWN	A - ANTICIPATED/PLANNED P - PRESENT
FUNCTION ID (6) (POSITION 5 - 10)	SYMBOL MODIFIER (2) (POSITION 11, 12)	COUNTRY CODE (2) (POSITION 13, 14)	ORDER OF BATTLE (1) (POSITION 15)
See table A-III for specific values.	See table A-II for specific values.	See FIPS Pub series 10	A - AIR OB E - ELECTRONIC OB C - CIVILIAN OB G - GROUND OB N - MARITIME OB S - STRATEGIC FORCE RELATED

Figure 18. Symbol Identification Code (SIDC) Positions and Categories
Source: DISA, Draft MIL-STD 2525C Department *of Defense Interface Standard: Common Warfighting Symbology* (Washington, DC: Government Printing Office, 2008), 78.

Column E indicates the symbol's measure of simplicity. Simplicity, for the purposes of this study, is defined as the number of elements contained in a symbol. In the friendly tactical satellite unit example shown above, the symbol contains 8 elements. These elements are the frame, the color inside the frame, the signal unit icon, the 3 rectangles in the center, the arc, and the line connecting the arc to the center rectangle. A large value for the simplicity parameter corresponds to a greater number of elements and therefore greater complexity.

Column F indicates the symbol's measure of closure. Closure, for the purposes of this study, is defined as the number of breaches of closure or open shapes within the symbol. A large value for the closure parameter corresponds to a greater number of open shapes and therefore greater simplicity.

Column G indicates the symbol's measure of continuity. Continuity, for the purposes of this study, is defined as the number of breaches of continuity, or the number of times one particular shape or line crosses another. A large value for the continuity parameter corresponds to a greater number of breaches of continuity and therefore greater complexity.

Column H indicates the symbol's number of internal lines. Number of lines in internal shape, for the purposes of this study, is defined as the number of lines contained within the symbol's frame. A larger value for this parameter corresponds to a greater number of internal lines and therefore greater complexity.

Column I indicates the symbol's number of arcs. Number of arcs, for the purposes of this study, is defined as the number of arcs contained within the symbol's frame. A larger value for this parameter corresponds to a greater number or arcs and therefore greater complexity.

Column J indicates the symbol's number of alphanumeric characters. Number of alphanumeric characters, for the purposes of this study, is defined as the number of alphanumeric characters contained within the symbol's frame. A larger value for this parameter corresponds to a greater number of alphanumeric characters and therefore greater complexity.

Column K indicates the symbol's measure of figural unity. Figural unity, for the purposes of this study, is defined as the number of breaches of figural unity, or the number of symbol components external to the frame of the symbol. A larger value for this parameter corresponds to a greater number of elements external to the frame of the

symbol and therefore greater complexity. In this study, only the ground installation symbols have breaches of figural unity.

Column L indicates the symbol's measure of symmetry. Symmetry, for the purposes of this study, is defined as the number of planes in which the symbol is asymmetric. A larger value for this parameter corresponds to a greater number of planes in which the symbol is asymmetric and therefore greater complexity.

Column M indicates the symbol's complexity coefficient. The complexity coefficient, for the purposes of this study, is defined as the sum of Columns F through M.

Column N indicates the symbol's unitized complexity coefficient for the worksheet. For the purposes of this study, this value is obtained by dividing the symbol's complexity coefficient by the mean complexity coefficient for all symbols in the worksheet.

Column O indicates the symbol's unitized complexity coefficient for the entire spreadsheet file. For the purposes of this study, this value is obtained by dividing the symbol's complexity coefficient by the mean complexity coefficient for all symbols in the spreadsheet file.

Comparison of Complexity Values

Having quantified each symbol's complexity among all 9 parameters, these values will be added to produce a complexity coefficient. The mean and standard deviation of each complexity parameter value and complexity coefficient will be taken and compared between ground combat, combat support, combat service support, and installation symbol sets, as well as subsets within each category. The worksheet and spreadsheet unitized values will be used for the comparison of individual symbols' complexity as well.

Symbology Change Proposal Process

In order to examine the methods by which warfighting symbology is updated, documents outlining the process will be obtained from DISA. The process will be examined in depth and potential complexity mitigating modifications to the process will be suggested and examined.

CHAPTER 4

ANALYSIS

Overall Analysis of Ground Track Warfighting Symbols

Mean complexity coefficients for all categories analyzed in this study are graphed in figure 19 based on the data in figure 20. As the data show, the mean complexity coefficients from 4 for information warfare units to 24 for landing support units. Both of these categories, however, consist of a single symbol. In the paragraphs that follow, each category will be discussed in greater detail.

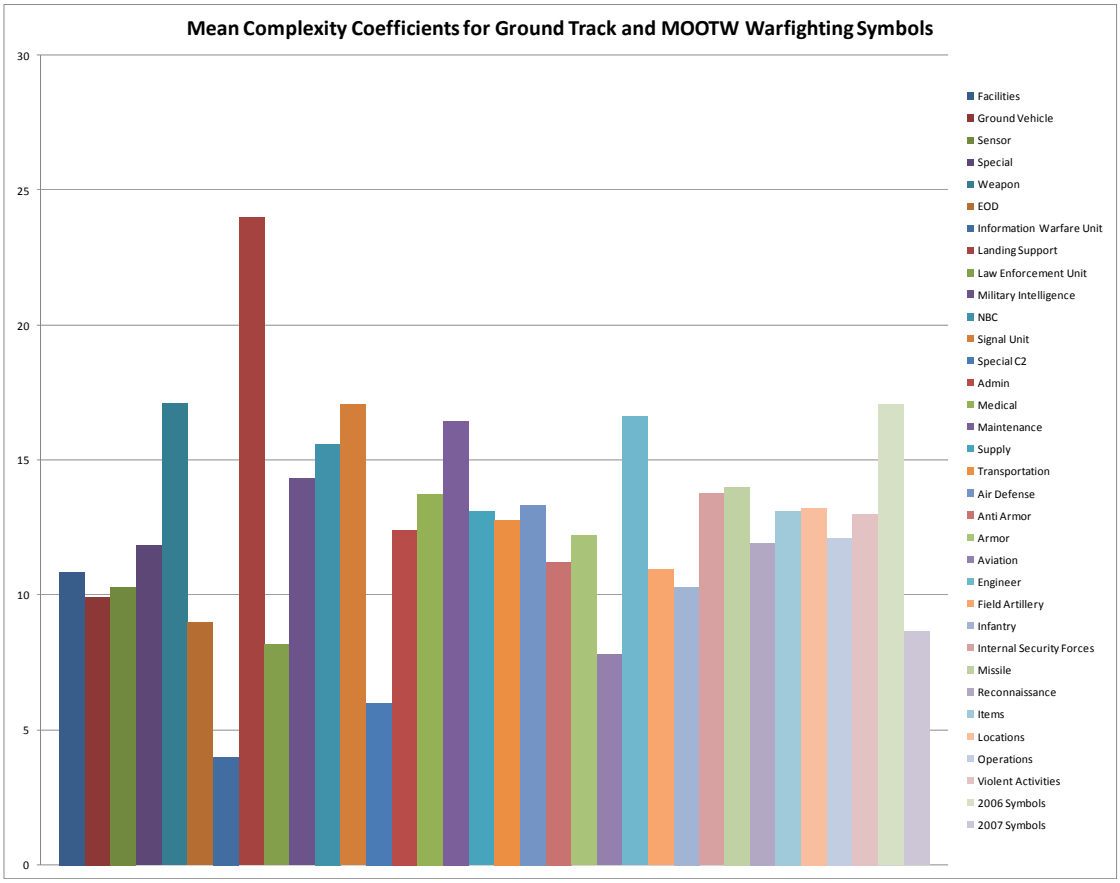


Figure 19. Mean Complexity Coefficients for Ground Warfighting Symbols
Source: Created by author.

Analysis of Ground Equipment Warfighting Symbols

Mean complexity coefficients for ground equipment warfighting symbols are graphed in figure 20 based on the data in figure 21. The mean complexity coefficient of symbols for ground weapons was found to be the highest among these symbols. The greatest contributors to this greater complexity were, as shown in figure 21, the number of elements and the number of internal lines.

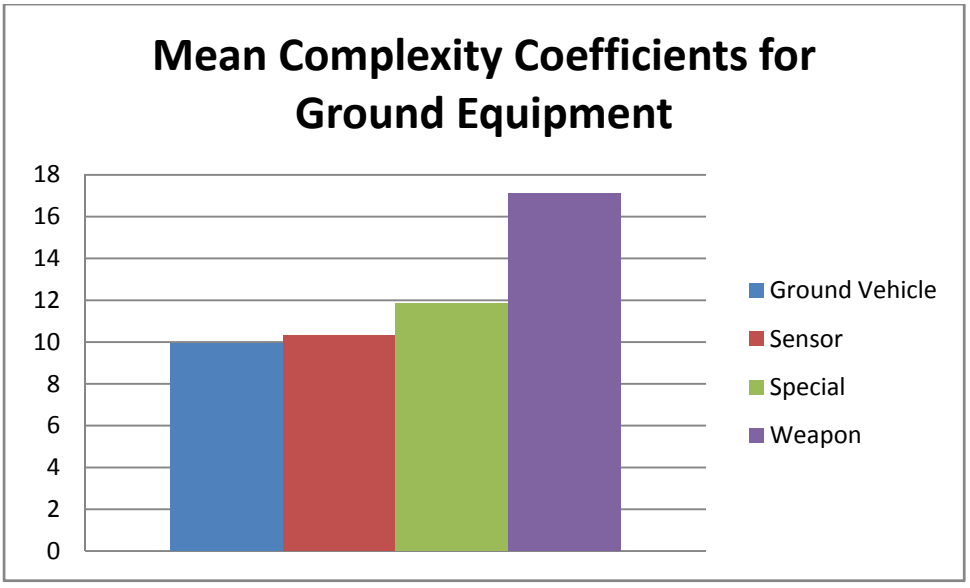


Figure 20. Mean Complexity Coefficients for Ground Equipment Warfighting Symbols

Source: Created by author.

Complexity Parameters	Category				
		Ground Vehicle	Sensor	Special	Weapon
	Elements				
	Mean	6.04878	6	6.666667	8.478261
	Standard Deviation	2.547826	3	4.633213	1.694357
	Closure				
	Mean	0	0	0	0.028986
	Standard Deviation	0	0	0	0.168995
	Continuity				
	Mean	0.146341	0	0	1.594203
	Standard Deviation	0.569209	0	0	1.228567
	External Lines				
	Mean	0	0	0	0
	Standard Deviation	0	0	0	0
	Internal Lines				
	Mean	1.719512	3	3.166667	5.347826
	Standard Deviation	1.476352	3	5.382069	1.739051
	Arcs				
	Mean	0.207317	0.333333	0.5	0.318841
	Standard Deviation	0.978003	0.57735	0.83666	0.469441
	Alphanumerics				
	Mean	0.341463	0	0.166667	0.217391
	Standard Deviation	1.157045	0	0.408248	0.615237
	Figural Unity				
	Mean	0	0	0	0
	Standard Deviation	0	0	0	0
	Symmetry				
	Mean	1.47561	1	1.333333	1.115942
	Standard Deviation	0.688989	1	0.516398	0.322501
	Complexity Coefficient				
	Mean	9.939024	10.33333	11.83333	17.10145
	Standard Deviation	4.678154	6.658328	9.928075	4.211835

Figure 21. Complexity Parameter Means and Standard Deviations for Ground Equipment Warfighting Symbols

Source: Created by author.

Analysis of Ground Installation Warfighting Symbols

Mean complexity coefficients and standard deviations for ground installation warfighting symbols are shown in figure 22. These values are not graphed because there are no subcategories of ground installation warfighting symbols and therefore no basis for comparison.

	Category	
		Facilities
Complexity Parameters	**Elements**	
	Mean	6.102564
	Standard Deviation	1.500787
	Closure	
	Mean	0
	Standard Deviation	0
	Continuity	
	Mean	0.282051
	Standard Deviation	0.60475
	External Lines	
	Mean	0
	Standard Deviation	0
	Internal Lines	
	Mean	0.641026
	Standard Deviation	1.135253
	Arcs	
	Mean	0.410256
	Standard Deviation	0.785324
	Alphanumerics	
	Mean	0.923077
	Standard Deviation	1.511093
	Figural Unity	
	Mean	1
	Standard Deviation	0
	Symmetry	
	Mean	1.512821
	Standard Deviation	0.50637
	Complexity Coefficient	
	Mean	10.87179
	Standard Deviation	3.434956

Figure 22. Complexity Parameter Means and Standard Deviations for Ground Installation Warfighting Symbols

Source: Created by author.

Analysis of Ground Combat Unit Warfighting Symbols

Mean complexity coefficients for ground combat unit warfighting symbols are graphed in figure 23 based on the data in figure 24. The mean complexity coefficient of symbols for engineer units was found to be the highest among these symbols. The greatest contributors to this greater complexity were, as shown in figure 24, the number of elements and the number of internal lines.

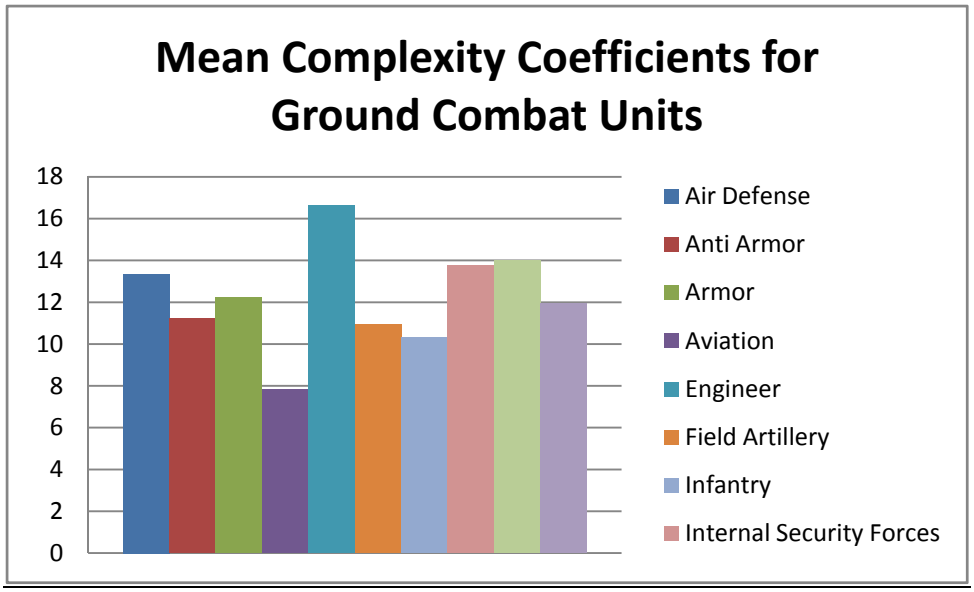


Figure 23. Mean Complexity Coefficients for Ground Combat Unit Warfighting Symbols

Source: Created by author.

	Category									
		Air Defense	Anti Armor	Armor	Aviation	Engineer	Field Artillery	Infantry	Internal Security Forces	Missile	Reconnaissance
Complexity Parameters	**Elements**										
	Mean	6.8823529	5.692308	7.61111	5.40909	8.214286	6.46808511	5.4	7.555555556	6.666667	5.882352941
	Standard Deviation	1.4090047	1.250641	4.0459	1.09801	1.625687	2.07313105	0.843274	2.65099562	0.57735	2.997548018
	Closure										
	Mean	0	0.384615	0	0	1.071429	0.04255319	0.1	0	1	0.058823529
	Standard Deviation	0	1.120897	0	0	0.267261	0.20402971	0.316228	0	0	0.242535625
	Continuity										
	Mean	0.3529412	1.307692	0.55556	0	0.214286	0.29787234	0.9	0.777777778	0	0.647058824
	Standard Deviation	0.8617697	1.887883	0.92178	0	0.578934	0.93051864	2.024846	1.56347192	0	1.05718828
	External Lines										
	Mean	0	0	0	0	0	0	0	0	0	0
	Standard Deviation	0	0	0	0	0	0	0	0	0	0
	Internal Lines										
	Mean	2.1176471	2.692308	0.33333	0.31818	4.285714	1.57446809	2.5	0.444444444	3	1.176470588
	Standard Deviation	1.5363249	1.031553	0.59409	0.71623	0.61125	1.44078301	0.707107	0.726483157	0	0.635933774
	Arcs										
	Mean	1.7058824	0	2.44444	0	0.285714	0.61702128	0.4	0	1	1.647058824
	Standard Deviation	0.5878675	0	3.72941	0	0.726273	1.71379558	0.843274	0	0	3.101233151
	Alphanumerics										
	Mean	0.8235294	0.076923	0.27778	1	1.142857	0.63829787	0.1	3	0.666667	0.529411765
	Standard Deviation	1.1311109	0.27735	0.46089	1.06904	1.91581	1.24106427	0.316228	0	0.57735	1.007326105
	Figural Unity										
	Mean	0	0	0	0	0	0	0	0	0	0
	Standard Deviation	0	0	0	0	0	0	0	0	0	0
	Symmetry										
	Mean	1.4705882	1.076923	1	1.09091	1.428571	1.31914894	0.9	2	1.666667	2
	Standard Deviation	0.5144958	0.27735	0.48507	0.61016	0.513553	0.5936762	0.737865	0	0.57735	0
	Complexity Coefficient										
	Mean	13.352941	11.23077	12.2222	7.81818	16.64286	10.9574468	10.3	13.77777778	14	11.94117647
	Standard Deviation	3.0401722	3.539158	8.49606	2.4031	3.564939	4.10173583	2.451757	3.19287401	1.732051	6.427194063

Figure 24. Complexity Parameter Means and Standard Deviations for Ground Combat Unit Warfighting Symbols

Source: Created by author.

Analysis of Ground Combat Service Support Unit Warfighting Symbols

Mean complexity coefficients for ground combat service support unit warfighting symbols are graphed in figure 25 based on the data in figure 26. The mean complexity coefficient of symbols for maintenance units was found to be the highest among these symbols. The greatest contributors to this greater complexity were, as shown in figure 26, the number of elements and the number of internal lines.

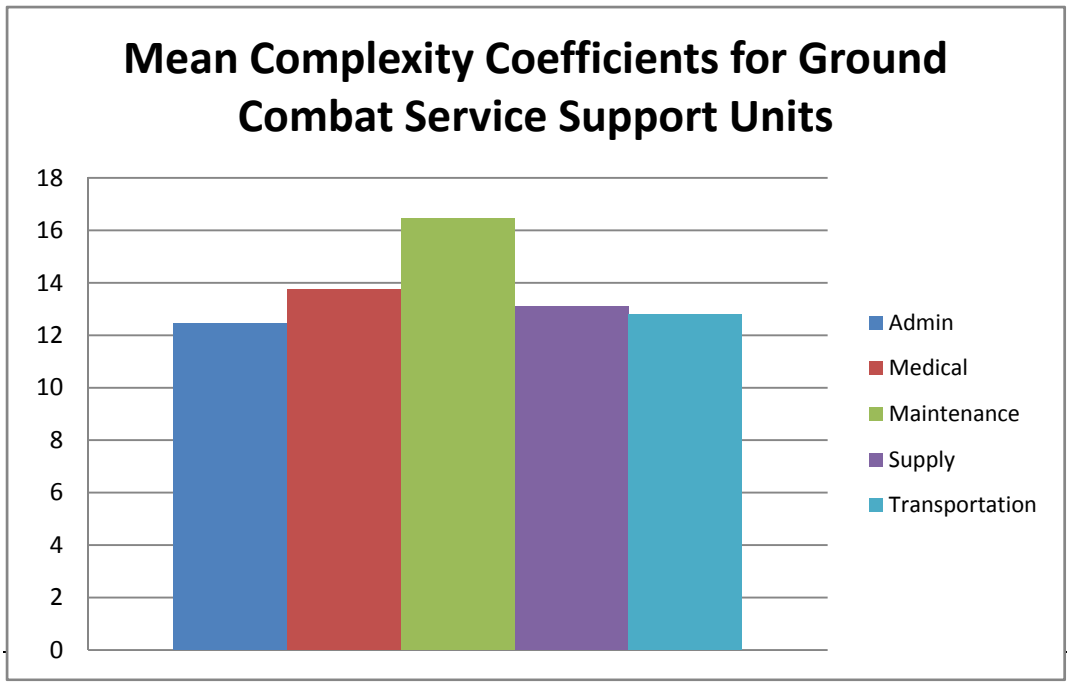


Figure 25. Mean Complexity Coefficients for Ground Combat Service Support Unit Warfighting Symbols

Source: Created by author.

Complexity Parameters	Category					
		Admin	Medical	Maintenance	Supply	Transportation
	Elements					
	Mean	6.567568	7	8.833333333	7.133333	7.5
	Standard Deviation	2.021283	1.812654	2.176073096	2.21154	2.431412081
	Closure					
	Mean	0	0	0.166666667	0.066667	0.166666667
	Standard Deviation	0	0	0.383482494	0.252262	0.383482494
	Continuity					
	Mean	0	0.4	0	0	0.166666667
	Standard Deviation	0	0.828079	0	0	0.383482494
	External Lines					
	Mean	0	0	0	0	0
	Standard Deviation	0	0	0	0	0
	Internal Lines					
	Mean	2	4.4	3.666666667	3.8	2.888888889
	Standard Deviation	1.699673	1.882248	2.029198625	2.159545	1.996729352
	Arcs					
	Mean	0	0	2	0.066667	0.166666667
	Standard Deviation	0	0	0	0.252262	0.383482494
	Alphanumerics					
	Mean	1.972973	0.6	0.5	0.4	0.5
	Standard Deviation	1.462237	0.507093	0.785905248	1.095445	1.150447483
	Figural Unity					
	Mean	0	0	0	0	0
	Standard Deviation	0	0	0	0	0
	Symmetry					
	Mean	1.891892	1.333333	1.277777778	1.644444	1.388888889
	Standard Deviation	0.3148	0.899735	0.669113158	0.48409	0.697802339
	Complexity Coefficient					
	Mean	12.43243	13.73333	16.44444444	13.11111	12.77777778
	Standard Deviation	4.252715	3.936399	4.501270699	4.588633	4.672265549

Figure 26. Complexity Parameter Means and Standard Deviations for Ground Combat Service Support Unit Warfighting Symbols

Source: Created by author.

Analysis of Ground Combat Support Unit Warfighting Symbols

Mean complexity coefficients for ground combat support unit warfighting symbols are graphed in figure 27 based on the data in figure 28. The mean complexity

coefficient of symbols for landing support units was found to be the highest among these symbols. Since, however, this category consists of a single symbol, the signal unit category provides a more suitable category for measurement of maximum mean complexity coefficient. The greatest contributors to this greater complexity were, as shown in figure 28, the number of elements and the number of internal lines.

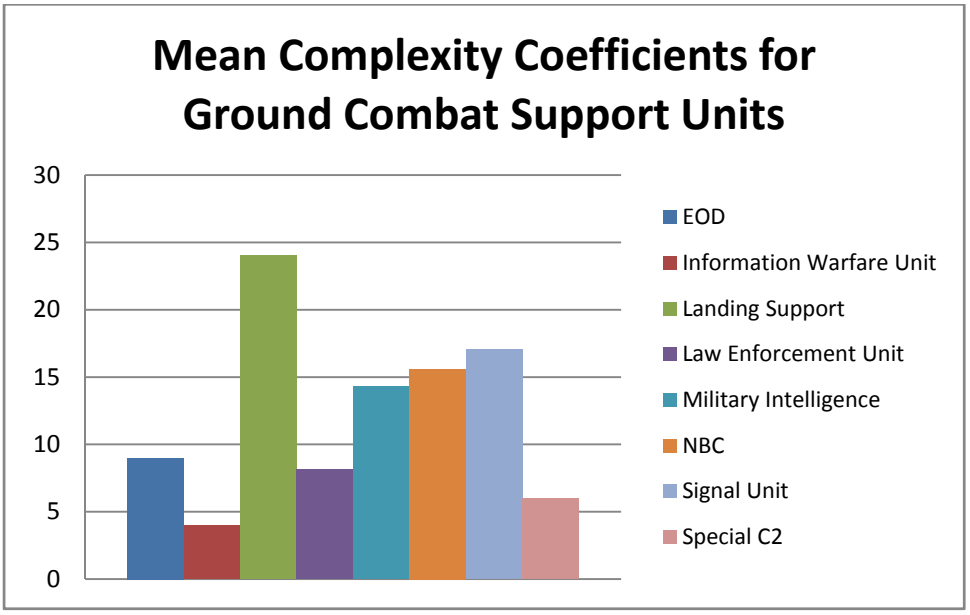


Figure 27. Mean Complexity Coefficients for Ground Combat Support Unit Warfighting Symbols

Source: Created by author.

Complexity Parameters	Category								
		EOD	Information Warfare Unit	Landing Support	Law Enforcement Unit	Military Intelligence	NBC	Signal Unit	Special C2
	Elements								
	Mean	4.5	4	12	4.5	7.28571429	8.266667	8.411765	3
	Standard Deviation	0.707107			1.048808848	3.56570971	1.791514	1.938389	
	Closure								
	Mean	0	0	0	0	0	0	0	0
	Standard Deviation	0			0	0	0	0	
	Continuity								
	Mean	0	0	0	0	0.19047619	1.8	0.647059	0
	Standard Deviation	0			0	0.87287156	2.210365	1.538716	
	External Lines								
	Mean	0	0	0	0	0	0	0	1
	Standard Deviation	0			0	0	0	0	
	Internal Lines								
	Mean	0	0	0	0	1.28571429	0.4	3.882353	0
	Standard Deviation	0			0	1.82051798	0.632456	2.088132	
	Arcs								
	Mean	0	0	8	0	0.80952381	2	0.176471	0
	Standard Deviation	0			0	3.48739226	0	0.528594	
	Alphanumerics								
	Mean	2.5	2	2	1.833333333	2.76190476	1.133333	1.941176	0
	Standard Deviation	0.707107			0.98319208	1.2208506	0.63994	1.519481	
	Figural Unity								
	Mean	0	0	0	0	0	0	0	0
	Standard Deviation	0			0	0	0	0	
	Symmetry								
	Mean	2	2	2	1.833333333	2	2	2	2
	Standard Deviation	0			0.40824829	0	0	0	
	Complexity Coefficient								
	Mean	9	4	24	8.166666667	14.3333333	15.6	17.05882	6
	Standard Deviation	1.414214			2.228601953	7.05218642	4.371989	4.264249	

Figure 28. Complexity Parameter Means and Standard Deviations for Ground Combat Support Unit Warfighting Symbols

Source: Created by author.

Analysis of MOOTW Warfighting Symbols and 2006 – 2007 Additions

Mean complexity coefficients for MOOTW warfighting symbols in MIL-STD 2525B and those added in 2006 and 2007 are graphed in figure 29 based on the data in figure 30. The mean complexity coefficient of MOOTW symbols added in 2006 was found to be the highest among these symbols. The greatest contributors to this greater

complexity were, as shown in figure 30, the number of elements and the number of internal lines, as well as breaches of continuity.

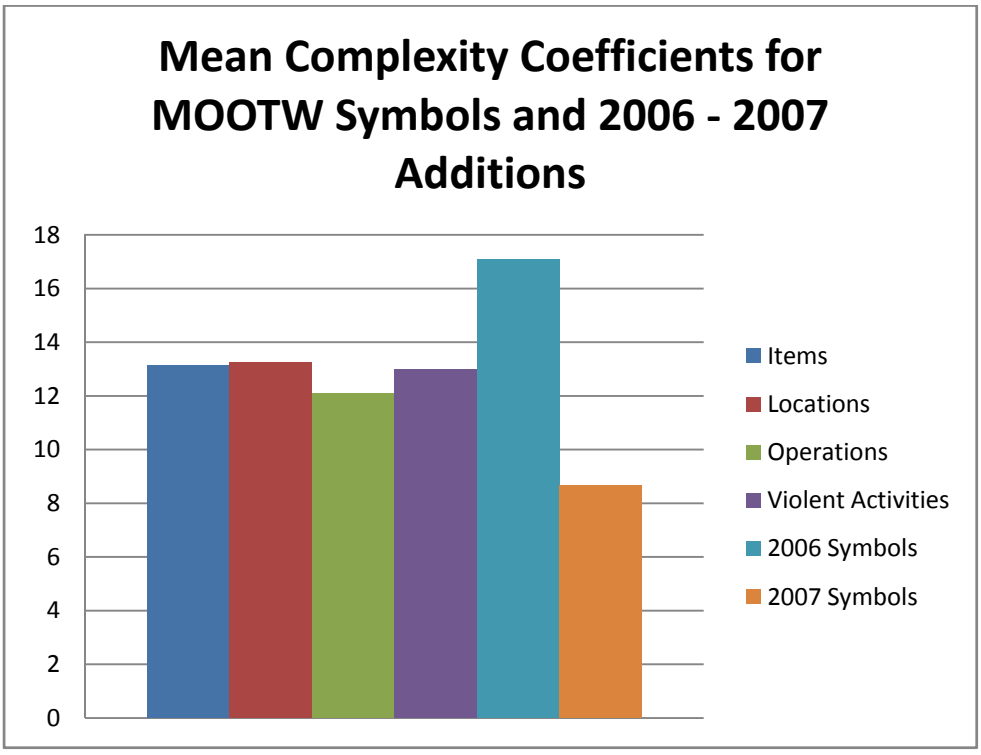


Figure 29. Mean Complexity Coefficients for MOOTW Warfighting Symbols and 2006-2007 Additions

Source: Created by author.

Complexity Parameters	Category						
		Items	Locations	Operations	Violent Activities	2006 Symbols	2007 Symbols
	Elements						
	Mean	7.285714	6.75	6.36842105	6.6	8.23077	4.666667
	Standard Deviation	2.627691	2.872281	1.38285238	1.264911	2.45472	1.527525
	Closure						
	Mean	0	0	0	0	0	0
	Standard Deviation	0	0	0	0	0	0
	Continuity						
	Mean	0.428571	0.75	0.78947368	0.9	2.07692	0
	Standard Deviation	1.133893	1.5	1.51213416	0.994429	0.95407	0
	External Lines						
	Mean	0	0	0	0	0	0
	Standard Deviation	0	0	0	0	0	0
	Internal Lines						
	Mean	1.142857	1.5	2	2.3	3.07692	0
	Standard Deviation	2.193063	3	2	1.337494	1.38212	0
	Arcs						
	Mean	1.428571	0	0.26315789	0	0	0
	Standard Deviation	2.992053	0	0.80568158	0	0	0
	Alphanumerics						
	Mean	1.571429	2.5	1	1.5	1.84615	2
	Standard Deviation	1.98806	1.732051	1.29099445	1.581139	1.28103	1.73201
	Figural Unity						
	Mean	0	0	0	0	0	0
	Standard Deviation	0	0	0	0	0	0
	Symmetry						
	Mean	1.285714	1.75	1.68421053	1.7	1.84615	2
	Standard Deviation	0.755929	0.5	0.58239273	0.483046	0.37553	0
	Complexity Coefficient						
	Mean	13.14286	13.25	12.1052632	13	17.0769	8.666667
	Standard Deviation	5.304984	5.251984	3.54173117	3.197221	4.80384	3.21455

Figure 30. Complexity Parameter Means and Standard Deviations for MOOTW Warfighting Symbols and 2006-2007 Additions

Source: Created by author.

Symbology Change Proposal Process Analysis

As previously discussed, neither the mandated interaction with LSAs nor the change proposal process incorporates any formal consideration of human factors, to

include complexity, into the change proposal process. The result is a process that uses voting by consensus to ultimately produce new warfighting symbols that have been found to be consistent with doctrine and compatible with DoD hardware and software. While such consistency and compatibility are vitally important, the complexity and thus the usefulness of the symbol in visualizing the battlespace is equally, if not more so, important to the end users of the symbols. In order to address this shortfall, there are a number of options which include discarding MIL-STD 2525 in favor of a new symbology based on human factors research; the incorporation of human factors expertise into the change proposal process via a human factors oversight panel or the addition of a SSMC voting member who would ensure that human factors are considered in change proposals that result in additional symbols; or the addition of a human factors based symbol design program to the change proposal process

Discarding MIL-STD 2525 in favor of a new symbology based on human factors research would provide the end user with the least complex and thus most effective symbology, but would require an extensive amount of highly specialized research and would require all end users to learn new symbology. Such a new symbology would also have the potential additional disadvantage of incompatibility with existing systems. Because of these disadvantages, such a new symbology is not likely to be developed in the near future.

The incorporation of human factors expertise into the change proposal process could be accomplished by adding a panel of experts or a SSMC voting member to ensure that human factors, such as complexity, are adequately considered in the development of a new symbol. The addition of this expertise would require the permanent addition of

one or more personnel to the SSMC and would have the advantage of minimally altering the change proposal process. The addition of this expertise would, however, require some degree of restructuring and would add to an already extensive bureaucracy.

The addition of a human factors based symbol design program to the change proposal process would provide the end user with new symbols that have been designed to convey the required information with the lowest possible degree of complexity. Such a program would use the complexity parameters discussed in this study controlled trials of candidate symbols to scientifically determine the best symbol. The addition of this program would have the advantage of providing the end user with the best possible symbol. Such a program would have the disadvantages of cost and of time. If the program were to be a permanent part of the change proposal process and were staffed by government personnel, significant restructuring would be required and the resulting bureaucracy would add ever increasing levels of inefficiency to the process. If the program were to be staffed by contract, however, it could be specifically tasked to produce and test candidate symbols in support of a change proposal. With a sole focus of producing and testing candidate symbols with scientific rigor, growth of the current bureaucracy would be minimized and the end users would be provided with the best possible symbols.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The research conducted in this study has determined that the Symbology Standards Management Committee (SSMC), which manages warfighting symbology as promulgated in MIL-STD 2525, considers doctrinal applicability and compliance with standards, but does not consider human factors aspects, to include complexity, of warfighting symbology. The change proposal process, through which the SSMC approves new symbols for inclusion in MIL-STD 2525, has arbitrarily generated symbols with no consideration given to their complexity and potential for misunderstanding.

This study established a method by which the complexity of warfighting symbols may be quantified through an examination of parameters which, when added, constitute a symbol's complexity coefficient. Through an examination of complexity coefficients for ground track and MOOTW warfighting symbols in MIL-STD 2525B and those added in 2006 and 2007, this study showed that the number of elements and the number of internal lines were the two parameters that contributed the most to the highest mean complexity coefficients in this sample of warfighting symbols. This study showed that these parameters were also most responsible for the highest mean complexity coefficients in MOOTW symbols added to MIL-STD 2525 in 2006 and 2007.

Recommendations

In order to mitigate increasing complexity in symbols added to MIL-STD 2525, the following recommendations are made:

1. Add a human factors based symbol design program to the change proposal process in the near term.

2. In the far term, evaluate all Warfighting symbols in MIL-STD 2525 in order to determine which are the most complex. Conduct testing with a sample of end users to determine the extent to which symbol complexity affects the end user's ability to use the symbols, and incrementally redesign the symbols using the human factors based symbol design program.

3. Require all new systems to have the capability to use warfighting symbols in the SVG format.

Human Factors Based Design and the Change Proposal Process

In the near term, the addition of human factors expertise to the change proposal process could help to ensure that the SSMC considers human factors aspects when adding warfighting symbols to MIL-STD 2525. One way in which this could be accomplished is through the addition of a human factors based symbol design program to the change proposal process. Such a program would provide the end user with new symbols that have been designed to convey the required information with the lowest possible degree of complexity. It would use the complexity parameters discussed in this study and controlled trials of candidate symbols to scientifically determine the best symbol. The addition of this program would have the advantage of providing the end user with the

best possible symbol. The composition and exact operation of this program are topics for further study.

Symbol Assessment and Redesign

Scientifically speaking, the ideal solution to the problem of warfighting symbology complexity would be to discard MIL-STD 2525 in favor of a novel symbology based entirely on human factors research and extensive experimentation. Such a solution is not realistic, however, given the cost in resources and time to implement it. An improved solution would combine two approaches in parallel. The first approach would put an end to arbitrary symbol design and use the complexity factors described in this research when adding new symbols to MIL-STD 2525, while the second would determine which of the existing warfighting symbols were most complex and problematic and would redesign them.

In the first approach, shown in figure 31, a symbol design process that incorporates the complexity parameters described in this research would be used for all new warfighting symbols approved for inclusion in MIL-STD 2525. After SSMC approval of a change proposal, the change proposal would be used to generate requirements for symbol design. These requirements would be used to determine the symbol's affiliation, the shape of the frame, and any applicable modifiers. Once these requirements had been determined, at least 2 candidate icons would be designed. The icons, affiliation color, and frames would then be combined to make complete symbols, which would then be tested in order to determine which would be selected for inclusion in MIL-STD 2525.

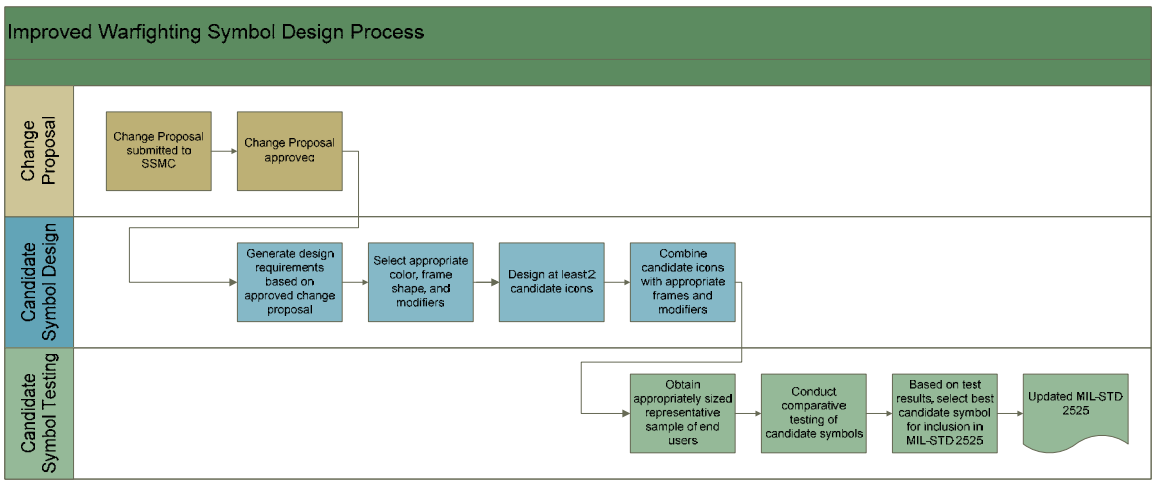


Figure 31. Improved Warfighting Symbol Design Process
Source: Created by author.

In the second approach, shown in figure 32, all warfighting symbols in MIL-STD 2525 would be reexamined using the methods described in this research to determine which are the most complex. Rigorous testing would then be conducted, using a sample population of end users in order to measure the effect of the high complexity coefficients on the end users' ability to use them. Those symbols found to be excessively complex for the end users would then be redesigned using the candidate symbol design and candidate symbol testing processes described in the first approach.

While such a novel symbology would be the optimal solution for the end user, there are two primary disadvantages to the approach. The first disadvantage involves the requirement to learn the new simplified symbols that replaced the previous, more complex symbols. Such a transition would have the potential to cause confusion and inconvenience for the end users. This could be mitigated, to an extent, by incrementally redesigning those symbols by beginning with those deemed to be the most complex and in need of change.

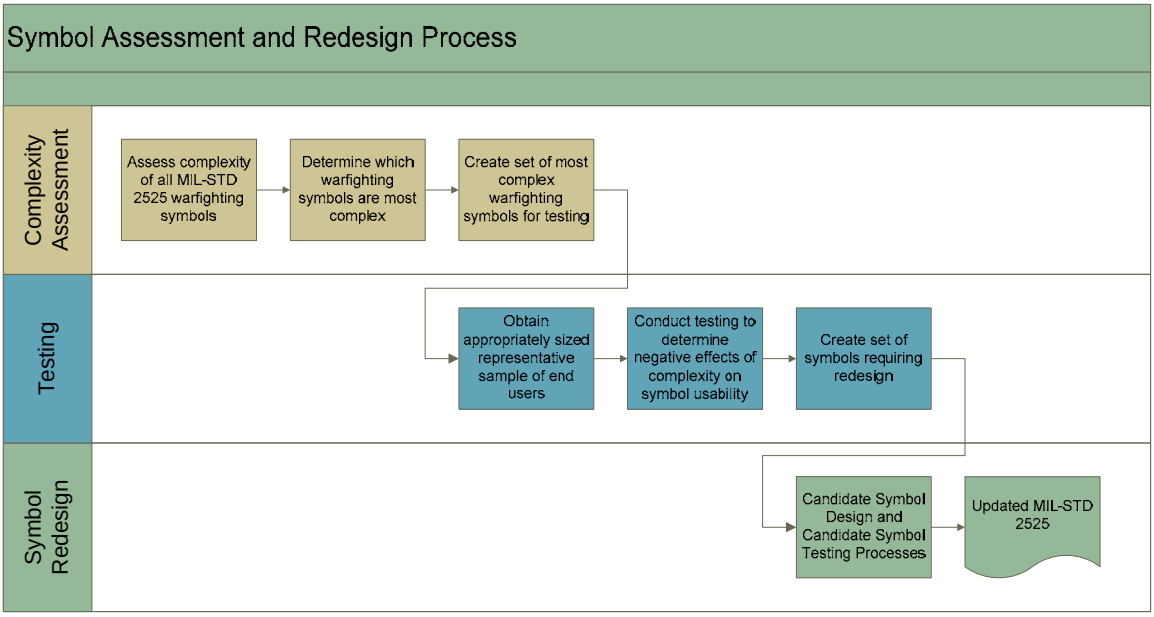


Figure 32. Symbol Assessment and Redesign Process
Source: Created by author.

The second disadvantage to the development of a novel symbology is concerned with the symbology's compatibility with existing systems. This disadvantage could be overcome by requiring all new systems, and upgrades to current systems, to be able to use symbols generated in the Scalable Vector Graphics, or SVG, format. In this format, the symbols would consist of lines of Extensible Markup Language, or XML code, that require significantly less memory and bandwidth to transmit than the conventional bitmap formats used today. The SVG format has the additional advantage of producing high resolution images regardless of the size. Since all MIL-STD 2525 warfighting symbols are currently produced in SVG format, upgrade of existing systems and the inclusion of SVG capability in new systems would be required. The high quality of the images and the savings in memory and bandwidth make this format ideal for the end user. Inclusion of the capability to use SVG graphics would also make the addition of new

symbols to existing systems easier and less costly. If and when this capability becomes a requirement in DoD systems that use MIL-STD 2525, these systems will function more efficiently, will be able to have the most current symbols, and the end user will have a simpler symbology designed around his needs.

GLOSSARY

Symbol. An object that presents information.

Tactical graphic. A category of warfighting symbology that provides information about objects necessary for battlefield planning and management.

Tactical symbol. A category of warfighting symbology that provides information about the standard identity, battle dimension, status, and mission of a warfighting object.

Text. Words, alphanumeric information, and other ASCII characters used to define or further designate the meaning of a symbol.

Warfighting symbology. Symbology used to plan and execute military operations in support of C2 functions. These symbols fall into two basic categories: tactical symbols and tactical graphics

APPENDIX A

GROUND EQUIPMENT DATA

Ground Vehicle Data Spreadsheets

Category	Sub-category 1	Sub-category 2	Sub-category 3	Sub-category 4	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
Ground Vehicle						sfgpev	6	0	0	1	0	0	0	1	8	0.80491	0.65031
Ground Vehicle	Armored					sfgpeva	7	0	0	0	1	0	0	1	9	0.90552	0.7316
Ground Vehicle	Armored	Armored Infantry				sfgpevai	5	0	0	2	0	0	0	0	7	0.70429	0.56902
Ground Vehicle	Armored	Armored Personnel Carrier				sfgpevaa	3	0	0	0	0	0	0	1	4	0.40245	0.32516
Ground Vehicle	Armored	Armored Personnel Carrier	Recovery			sfgpevaar	6	0	0	1	2	0	0	1	10	1.00613	0.81289
Ground Vehicle	Armored	C2VACV				sfgpevac	8	0	0	5	0	0	0	2	15	1.5092	1.21933
Ground Vehicle	Armored	Combat Service Support Vehicle				sfgpevas	4	0	0	1	0	0	0	1	6	0.60368	0.48773

Ground Vehicle	Armored	Light Armored Vehicle				sfgpeval	9	0	0	3	0	0	0	1	13	1.30798	1.05676
Ground Vehicle	Armored	Tank				sfgpevat	3	0	0	0	0	0	0	0	3	0.30184	0.24387
Ground Vehicle	Armored	Tank	Heavy			sfgpevath	6	0	0	3	0	0	0	0	9	0.90552	0.7316
Ground Vehicle	Armored	Tank	Heavy	Recovery		sfgpevathr	9	0	3	4	2	0	0	0	18	1.81104	1.4632
Ground Vehicle	Armored	Tank	Light			sfgpevatl	4	0	0	1	0	0	0	0	5	0.50307	0.40644
Ground Vehicle	Armored	Tank	Light	Recovery		sfgpevatlr	7	0	1	2	2	0	0	0	12	1.20736	0.97547
Ground Vehicle	Armored	Tank	Medium			sfgpevatm	5	0	0	2	0	0	0	0	7	0.70429	0.56902

Ground Vehicle	Armored	Tank	Medium	Recovery		sfgpevatmr	8	0	2	3	2	0	0	0	15	1.5092	1.21933
Civilian Vehicle						sfgpevc	5	0	0	0	0	3	0	2	10	1.00613	0.81289
Civilian Vehicle	Automobile					sfgpevca	3	0	0	0	0	0	0	2	5	0.50307	0.40644
Civilian Vehicle	Automobile	Compact				sfgpevcal	4	0	0	1	0	0	0	2	7	0.70429	0.56902
Civilian Vehicle	Automobile	Midsize				sfgpevcam	5	0	0	2	0	0	0	2	9	0.90552	0.7316
Civilian Vehicle	Automobile	Sedan				sfgpevcah	6	0	0	3	0	0	0	2	11	1.10675	0.89418
Civilian Vehicle	Jeep Type Vehicle					sfgpevcj	3	0	0	0	0	0	0	2	5	0.50307	0.40644

Civilian Vehicle	Open Bed Truck					sfgpevco	3	0	0	0	0	0	0	2	5	0.50307	0.40644
Civilian Vehicle	Open Bed Truck	Large				sfgpevcoh	6	0	0	3	0	0	0	2	11	1.10675	0.89418
Civilian Vehicle	Open Bed Truck	Pickup				sfgpevcol	4	0	0	1	0	0	0	2	7	0.70429	0.56902
Civilian Vehicle	Open Bed Truck	Small				sfgpevcom	5	0	0	2	0	0	0	2	9	0.90552	0.7316
Civilian Vehicle	Tractor Trailer Truck with Box Trailer					sfgpevct	3	0	0	0	0	0	0	2	5	0.50307	0.40644
Civilian Vehicle	Tractor Trailer Truck with Box Trailer	Large Heavy Box Trailer				sfgpevcth	6	0	0	3	0	0	0	2	11	1.10675	0.89418
Civilian Vehicle	Tractor Trailer Truck with Box Trailer	Medium Box Trailer				sfgpevctm	5	0	0	2	0	0	0	2	9	0.90552	0.7316

Civilian Vehicle	Tractor Trailer Truck with Box Trailer	Small Light Box Trailer				sfgpevctl	4	0	0	1	0	0	0	2	7	0.70429	0.56902
Civilian Vehicle	Tractor Trailer Truck with Flatbed Trailer					sfgpevcf	3	0	0	0	0	0	0	2	5	0.50307	0.40644
Civilian Vehicle	Tractor Trailer Truck with Flatbed Trailer	Large Heavy Flatbed Trailer				sfgpevcfh	6	0	0	3	0	0	0	2	11	1.10675	0.89418
Civilian Vehicle	Tractor Trailer Truck with Flatbed Trailer	Medium Flatbed Trailer				sfgpevcfm	5	0	0	2	0	0	0	2	9	0.90552	0.7316
Civilian Vehicle	Tractor Trailer Truck with Flatbed Trailer	Small Light Flatbed Trailer				sfgpevcfl	4	0	0	1	0	0	0	2	7	0.70429	0.56902
Civilian Vehicle	Utility Vehicle					sfgpevcu	3	0	0	0	0	0	0	2	5	0.50307	0.40644
Civilian Vehicle	Utility Vehicle	Large Box Truck				sfgpevcuh	6	0	0	3	0	0	0	2	11	1.10675	0.89418

Civilian Vehicle	Utility Vehicle	Small Box Truck				sfgpevcum	5	0	0	2	0	0	0	2	9	0.90552	0.73316
Civilian Vehicle	Utility Vehicle	Sport Utility Vehicle				sfgpevcul	4	0	0	1	0	0	0	2	7	0.70429	0.56902
Engineer Vehicle						sfgpeve	10	0	0	5	0	0	0	1	16	1.60982	1.30062
Engineer Vehicle	Armored Assault					sfgpeves	7	0	0	4	0	0	0	1	12	1.20736	0.97547
Engineer Vehicle	Armored Engineer Recon Vehicle					sfgpever	8	0	2	5	0	0	0	2	17	1.71043	1.38191
Engineer Vehicle	Backhoe					sfgpeveh	8	0	0	2	0	0	0	2	12	1.20736	0.97547
Engineer Vehicle	Bridge					sfgpeveb	4	0	0	0	0	0	0	0	4	0.40245	0.32516

Engineer Vehicle	Construction Vehicle					sfgpevec	9	0	0	4	0	0	0	1	14	1.40859	1.13804
Engineer Vehicle	Dozer					sfgpeved	5	0	0	2	0	0	0	1	8	0.80491	0.65031
Engineer Vehicle	Dozer	Armored				sfgpeveda	5	0	0	2	0	0	0	1	8	0.80491	0.65031
Engineer Vehicle	Earth Mover					sfgpevee	5	0	0	2	0	0	0	1	8	0.80491	0.65031
Engineer Vehicle	Ferry Transporter					sfgpevef	7	0	0	0	0	0	0	1	8	0.80491	0.65031
Engineer Vehicle	Mine Clearing Vehicle					sfgpevea	4	0	0	1	0	0	0	1	6	0.60368	0.48773
Engineer Vehicle	Mine Clearing Vehicle	Armored Vehicle Mounted				sfgpeveaa	5	0	0	1	0	0	0	1	7	0.70429	0.56902

Engineer Vehicle	Mine Clearing Vehicle	Trailer Mounted				sfgpeveat	6	0	0	1	0	0	0	1	8	0.80491	0.65031
Engineer Vehicle	Mine Laying Vehicle					sfgpevem	4	0	0	0	0	0	0	1	5	0.50307	0.40644
Engineer Vehicle	Mine Laying Vehicle	Armored Carrier with Volcano				sfgpevemv	5	0	0	2	0	0	0	1	8	0.80491	0.65031
Engineer Vehicle	Mine Laying Vehicle	Truck Mounted with Volcano				sfgpeveml	7	0	0	2	0	0	0	1	10	1.00613	0.81289
Missile Support						sfgpeves	12	0	0	1	0	6	0	2	21	2.11288	1.70707
Missile Support	Crane Loading Device					sfgpevsc	12	0	0	1	0	3	0	2	18	1.81104	1.4632
Missile Support	Propellant Transporter					sfgpevsp	11	0	0	2	0	3	0	2	18	1.81104	1.4632

Missile Support	Transloader					sfgpevst	11	0	0	3	0	3	0	2	19	1.91166	1.54449
Missile Support	Transporter					sfgpevsr	10	0	0	2	0	3	0	2	17	1.71043	1.38191
Missile Support	Warhead Transporter					sfgpevsw	12	0	0	1	0	6	0	2	21	2.11288	1.70707
Pack Animals						sfgpevm	6	0	0	4	0	0	0	1	11	1.10675	0.89418
Train Locomotive						sfgpevt	3	0	0	0	0	0	0	2	5	0.50307	0.40644
Utility Vehicle						sfgpevu	3	0	0	0	0	0	0	1	4	0.40245	0.32516
Utility Vehicle	Ambulance					sfgpevua	4	0	0	0	0	0	0	1	5	0.50307	0.40644

Utility Vehicle	Ambulance	Armored				sfgpevuaa	4	0	0	0	0	0	0	1	5	0.50307	0.40644
Utility Vehicle	Bus					sfgpevub	4	0	0	0	0	1	0	2	7	0.70429	0.56902
Utility Vehicle	Cross Country Truck					sfgpevux	6	0	0	0	0	0	0	1	7	0.70429	0.56902
Utility Vehicle	Limited Cross Country Truck					sfgpevul	5	0	0	0	0	0	0	1	6	0.60368	0.48773
Utility Vehicle	Semi					sfgpevus	8	0	0	2	0	0	0	2	12	1.20736	0.97547
Utility Vehicle	Semi	Heavy				sfgpevush	11	0	0	5	0	0	0	2	18	1.81104	1.4632
Utility Vehicle	Semi	Light				sfgpevusl	9	0	0	3	0	0	0	2	14	1.40859	1.13804

Utility Vehicle	Semi	Medium				sfgpevusm	10	0	0	4	0	0	0	2	16	1.60982	1.30062
Utility Vehicle	Tow Truck					sfgpevut	6	0	0	2	0	0	0	2	10	1.00613	0.81289
Utility Vehicle	Tow Truck	Heavy				sfgpevuth	9	0	3	5	0	0	0	2	19	1.91166	1.54449
Utility Vehicle	Tow Truck	Light				sfgpevutl	7	0	1	3	0	0	0	2	13	1.30798	1.05676
Utility Vehicle	Watercraft					sfgpevur	13	0	0	0	8	0	0	2	23	2.31411	1.86965
						Mean	6.0488	0	0.146341	1.72	0.2	0.3415	0	1.475609756	9.939024		
						Std. Dev.	2.5478	0	0.569209	1.476	1	1.157	0	0.688989415	4.678154		

Sensor Data Spreadsheet

Category	Sub-category 1	Sub-category 2	Sub-category 3	Sub-category 4	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitization	Spread-sheet Unitization
Sensor						sfgpes	3	0	0	0	0	0	0	0	3	0.290323	0.243867
Sensor	Emplaced					sfgpese	9	0	0	6	0	0	0	1	16	1.548387	1.300623
Sensor	Radar					sfgpesr	6	0	0	3	1	0	0	2	12	1.16129	0.975467
						Mean	6	0	0	3	0.333	0	0	1	10.33333333		
						Std. Dev.	3	0	0	3	0.577	0	0	1	6.658328118		

Special Equipment Data Spreadsheet

Category	Sub-category 1	Sub-category 2	Sub-category 3	Sub-category 4	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitization	Spread-sheet Unitization
Special	Flame Thrower					sfgpexf	4	0	0	1	1	0	0	2	8	0.67606	0.650311
Special	Land Mines					sfgpexm	4	0	0	0	0	1	0	1	6	0.50704	0.487734
Special	Land Mines	Claymore				sfgpexmc	5	0	0	2	0	0	0	1	8	0.67606	0.650311
Special	Land Mines	Less than Lethal				sfgpexml	5	0	0	2	0	0	0	1	8	0.67606	0.650311
Special	Laser					sfgpexl	16	0	0	14	0	0	0	2	32	2.70423	2.601245
Special	NBC Equipment					sfgpexn	6	0	0	0	2	0	0	1	9	0.76056	0.7316
						Mean	6.6667	0	0	3.167	0.5	0.16667	0	1.33333	11.833333		
						Std. Dev.	4.6332	0	0	5.382	0.84	0.40825	0	0.5164	9.9280747		

Ground Weapon Data Spreadsheets

Category	Sub-category 1	Sub-category 2	Sub-category 3	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitization	Spread-sheet Unitization
Air Defense Gun					sfgpewa	6	0	0	3	0	0	0	1	10	0.58474576	0.81288917
Air Defense Gun	Heavy				sfgpewah	9	0	3	6	0	0	0	1	19	1.11101695	1.54448942
Air Defense Gun	Light				sfgpewal	7	0	1	4	0	0	0	1	13	0.76016949	1.05675592
Air Defense Gun	Medium				sfgpewam	8	0	2	5	0	0	0	1	16	0.93559322	1.30062267
Anti Tank Gun					sfgpewg	7	0	0	5	0	0	0	1	13	0.76016949	1.05675592
Anti Tank Gun	Heavy				sfgpewgh	10	0	3	8	0	0	0	1	22	1.28644068	1.78835618
Anti Tank Gun	Light				sfgpewgl	8	0	1	6	0	0	0	1	16	0.93559322	1.30062267
Anti Tank Gun	Medium				sfgpewgm	9	0	2	7	0	0	0	1	19	1.11101695	1.54448942
Anti Tank Gun	Recoilless				sfgpwegr	7	0	0	5	0	0	0	1	13	0.76016949	1.05675592
Anti Tank Rocket Launcher					sfgpewt	9	0	0	7	0	0	0	1	17	0.9940678	1.38191159
Anti Tank Rocket Launcher	Heavy				sfgpewth	12	0	3	10	0	0	0	1	26	1.52033898	2.11351184
Anti Tank Rocket Launcher	Light				sfgpewtl	10	0	1	8	0	0	0	1	20	1.16949153	1.62577834
Anti Tank Rocket Launcher	Medium				sfgpwetm	11	0	2	9	0	0	0	1	23	1.34491525	1.86964509
Direct Fire Gun					sfgpewd	5	0	0	3	0	0	0	1	9	0.52627119	0.73160025

Anti Tank Gun	Medium				sfgpewgm	9	0	2	7	0	0	0	1	19	1.11101695	154448942
Anti Tank Gun	Recoilless				sfgpwegr	7	0	0	5	0	0	0	1	13	0.76016949	105675592
Anti Tank Rocket Launcher					sfgpewt	9	0	0	7	0	0	0	1	17	0.9940678	138191159
Anti Tank Rocket Launcher	Heavy				sfgpewth	12	0	3	10	0	0	0	1	26	1.52033898	211351184
Anti Tank Rocket Launcher	Light				sfgpewtl	10	0	1	8	0	0	0	1	20	1.16949153	162577834
Anti Tank Rocket Launcher	Medium				sfgpwetm	11	0	2	9	0	0	0	1	23	1.34491525	186964509
Direct Fire Gun					sfgpewd	5	0	0	3	0	0	0	1	9	0.52627119	0.73160025

Direct Fire Gun	Heavy				sfgpewdh	8	0	3	6	0	0	0	1	18	1.05254237	146320051
Direct Fire Gun		Self Propelled			sfgpewdhs	9	0	3	6	0	0	0	1	19	1.11101695	154448942
Direct Fire Gun	Light				sfgpewdl	6	0	1	4	0	0	0	1	12	0.70169492	0.975467
Direct Fire Gun		Self Propelled			sfgpewdls	7	0	1	4	0	0	0	1	13	0.76016949	105675592
Direct Fire Gun	Medium				sfgpewdm	7	0	2	5	0	0	0	1	15	0.87711864	121933376
Direct Fire Gun		Self Propelled			sfgpewdms	8	0	2	5	0	0	0	1	16	0.93559322	130062267
Grenade Launcher					sfgpewz	6	0	2	3	0	0	0	1	12	0.70169492	0.975467

Grenade Launcher	Heavy				sfgpewzh	9	0	5	6	0	0	0	1	21	12279661	170706726
Grenade Launcher	Light				sfgpewzl	7	0	3	4	0	0	0	1	15	0.87711864	121933376
Grenade Launcher	Medium				sfgpewzm	8	0	4	5	0	0	0	1	18	105254237	146320051
Howitzer					sfgpewh	6	0	0	3	0	0	0	1	10	0.58474576	0.81288917
Howitzer	Heavy				sfgpewhh	9	0	3	6	0	0	0	1	19	111101695	154448942
Howitzer		Self Propelled			sfgpewhhs	10	0	3	6	0	0	0	1	20	116949153	162577834
Howitzer	Light				sfgpewhl	7	0	1	4	0	0	0	1	13	0.76016949	105675592

Howitzer		Self Propelled			sfgpewhls	8	0	1	4	0	0	0	1	14	0.81864407	113804484
Howitzer	Medium				sfgpewhm	8	0	2	5	0	0	0	1	16	0.93559322	130062267
Howitzer		Self Propelled			sfgpewhms	9	0	2	5	0	0	0	1	17	0.9940678	138191159
Missile Launcher					sfgpewm	6	1	0	3	1	0	0	1	12	0.70169492	0.975467
Missile Launcher	Air Defense				sfgpewma	7	0	0	3	1	0	0	1	12	0.70169492	0.975467
Missile Launcher	Air Defense	Intermediate Range			sfgpewmai	9	0	2	5	1	0	0	1	18	105254237	146320051
Missile Launcher	Air Defense	Intermediate Range	TELAR		sfgpewmaie	11	0	2	5	1	2	0	2	23	134491525	186964509

Missile Launcher	Air Defense	Intermediate Range	TLAR		sfgpewmair	10	0	2	5	1	1	0	2	21	12279661	170706726
Missile Launcher	Air Defense	Long Range			sfgpewmal	10	0	3	6	1	0	0	1	21	12279661	170706726
Missile Launcher	Air Defense	Long Range	TELAR		sfgpewmale	12	0	3	6	1	2	0	2	26	152033898	2.11351184
Missile Launcher	Air Defense	Long Range	TLAR		sfgpewmalr	11	0	3	6	1	1	0	2	24	140338983	195093401
Missile Launcher	Air Defense	Short Range			sfgpewmas	8	0	1	4	1	0	0	1	15	0.87711864	121933376
Missile Launcher	Air Defense	Short Range	TELAR		sfgpewmase	10	0	1	4	1	2	0	2	20	1.16949153	162577834
Missile Launcher	Air Defense	Short Range	TLAR		sfgpewmasr	9	0	1	4	1	1	0	2	18	105254237	146320051

Missile Launcher	Air Defense	Theater			sfgpewmat	8	0	0	3	1	1	0	1	14	0.81864407	113804484
Missile Launcher	Air Defense	Theater	TELAR		sfgpewmate	10	0	0	3	1	3	0	2	19	1.11101695	154448942
Missile Launcher	Air Defense	Theater	TLAR		sfgpewmatr	9	0	0	3	1	2	0	2	17	0.9940678	138191159
Missile Launcher	Air Defense				sfgpewmt	8	1	0	5	1	0	0	1	16	0.93559322	130062267
Missile Launcher	Air Defense	Heavy			sfgpewmth	11	0	3	6	1	0	0	1	22	128644068	178835618
Missile Launcher	Air Defense	Light			sfgpewmtl	9	0	1	6	1	0	0	1	18	105254237	146320051
Missile Launcher	Air Defense	Medium			sfgpewmtm	10	0	2	7	1	0	0	1	21	12279661	170706726

Missile Launcher	Surface to Surface				sfgpewms	7	0	0	4	1	0	0	1	13	0.76016949	105675592
Missile Launcher	Surface to Surface	Intermediate Range			sfgpewmsi	9	0	2	6	1	0	0	1	19	1.11101695	154448942
Missile Launcher	Surface to Surface	Long Range			sfgpewmsl	10	0	3	7	1	0	0	1	22	1.28644068	178835618
Missile Launcher	Surface to Surface	Short Range			sfgpewmss	8	0	1	5	1	0	0	1	16	0.93559322	130062267
Mortar					sfgpewo	6	0	0	3	0	0	0	1	10	0.58474576	81288917
Mortar	Heavy				sfgpewoh	9	0	3	6	0	0	0	1	19	1.11101695	154448942
Mortar	Medium				sfgpewol	7	0	1	4	0	0	0	1	13	0.76016949	105675592

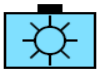
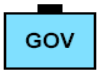
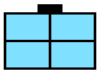
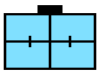
Mortar	Light				sfgpewom	9	0	2	5	0	0	0	1	17	0.99406678	138191159
Multiple Rocket Launcher					sfgpewx	9	0	0	7	0	0	0	1	17	0.99406678	138191159
Multiple Rocket Launcher	Heavy				sfgpewxh	12	0	3	10	0	0	0	1	26	1.52033898	211351184
Multiple Rocket Launcher	Light				sfgpewxl	10	0	1	8	0	0	0	1	20	1.16949153	162577834
Multiple Rocket Launcher	Medium				sfgpewxm	11	0	2	9	0	0	0	1	23	1.34491525	186964509
Rifle Automatic Weapon					sfgpewr	5	0	0	3	0	0	0	1	9	0.52627119	73160025
Rifle Automatic Weapon	Heavy Machine Gun				sfgpewrh	8	0	3	6	0	0	0	1	18	1.05254237	146320051

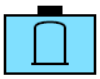
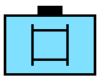
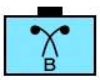
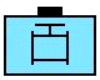
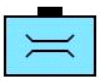
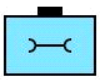
Rifle Automatic Weapon	Light Machine Gun				sfgpewrl	7	0	2	5	0	0	0	1	15	0.87711864	1.21933376
Rifle Automatic Weapon	Rifle				sfgpewrr	6	0	1	4	0	0	0	1	12	0.70169492	0.975467
Single Rocket Launcher					sfgpews	7	0	0	5	0	0	0	1	13	0.76016949	1.05675592
Single Rocket Launcher	Heavy				sfgpewsh	10	0	3	8	0	0	0	1	22	1.28644068	1.78835618
Single Rocket Launcher	Light				sfgpewsl	8	0	1	6	0	0	0	1	16	0.93559322	1.30062267
Single Rocket Launcher	Medium				sfgpewsm	9	0	2	7	0	0	0	1	19	1.11101695	1.54448942
					Mean	8.478261	0.02899	1.5942	5.34783	0.32	0.217391	0	1.15942	17.1014493		
					Std. Dev.	1.694357	0.16899	1.22857	1.73905	0.47	0.615237	0	0.3225009	4.21183531		

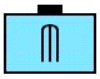
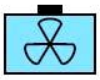
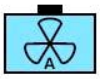
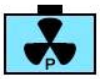
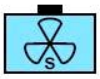
APPENDIX B

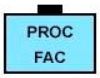
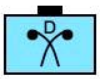
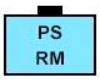
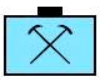
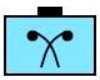
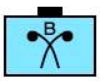
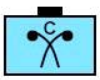
GROUND INSTALLATION DATA

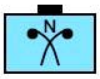
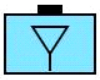
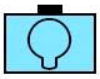
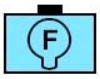
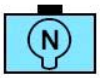
Ground Installation Data Spreadsheets

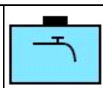
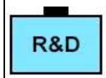
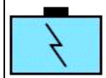
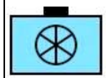
Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitization	Spread-sheet Unitization
Equipment Manufacture				sfgpie----h---	4	0	0	0	0	0	1	1	6	0.551886791	0.551886792
Government Leadership				sfgpig----h---	6	0	0	0	0	3	1	2	12	1.10377358	1.103773585
Medical Facility				sfgpix----h---	5	0	1	2	0	0	1	1	10	0.919811321	0.919811321
Medical Facility	Hospital			sfgpixh---h---	7	0	3	4	0	0	1	1	16	1.471698113	1.471698113
Military Base Facility				sfgpib---h---	5	0	1	2	0	0	1	1	10	0.919811321	0.919811321
Military Base Facility	Airport Airbase			sfgpiba---h---	6	0	0	2	0	0	1	2	11	1.011792453	1.011792453
Military Base Facility	Seaport Naval Base			sfgpibn---h---	4	0	0	0	0	0	1	1	6	0.551886791	0.551886792

Military Materiel Facility	Aircraft Production & Assembly			sfgpima---h---	4	0	0	0	0	0	1	2	7	0.64386792	0.643867925
Military Materiel Facility	Ammunition & Explosives Production			sfgpime---h---	4	0	0	0	0	0	1	1	6	0.55188679	0.551886792
Military Materiel Facility	Armament Production			sfgpimg---h---	4	0	0	0	0	0	1	1	6	0.55188679	0.551886792
Military Materiel Facility	Chemical & Biological Warfare Production			sfgpimc---h---	8	0	0	0	2	1	1	2	14	1.28773585	1.287735849
Military Materiel Facility	Engineering Equipment Production			sfgpimn---h---	6	0	0	2	0	0	1	1	10	0.91981132	0.919811321
Military Materiel Facility	Engineering Equipment Production	Bridge		sfgpimnb---h---	4	0	0	0	0	0	1	1	6	0.55188679	0.551886792
Military Materiel Facility	Military Vehicle Production			sfgpimv---h---	6	0	0	1	2	0	1	1	11	1.01179245	1.011792453

Military Materiel Facility	Missile and Space System Production			sfgpimm---h---	7	0	0	3	1	0	1	1	13	1.19575472	1.195754717
Military Materiel Facility	Nuclear Energy			sfgpimf---h---	6	0	0	0	0	0	1	1	8	0.73584906	0.735849057
Military Materiel Facility	Nuclear Energy	Atomic Energy Reactor		sfgpimfa--h---	7	0	0	0	0	1	1	1	10	0.91981132	0.919811321
Military Materiel Facility	Nuclear Material Production			sfgpimfp--h---	7	0	0	0	0	1	1	2	11	1.01179245	1.011792453
Military Materiel Facility	Nuclear Material Production	Weapons Grade		sfgpimfpw-h---	7	0	0	0	0	1	1	2	11	1.01179245	1.011792453
Military Materiel Facility	Nuclear Material Storage			sfgpimfs--h---	7	0	0	0	0	1	1	2	11	1.01179245	1.011792453
Military Materiel Facility	Ship Constructio n			sfgpims---h---	7	0	0	0	0	3	1	2	13	1.19575472	1.195754717

Processing Facility				sfgpip----h---	10	0	0	0	0	7	1	2	20	183962264	1839622642
Processing Facility	Decontamination			sfgpipd---h---	8	0	1	0	2	1	1	2	15	137971698	1379716981
Raw Material Production Storage				sfgpir----h---	7	0	0	0	0	4	1	2	14	128773585	1287735849
Raw Material Production Storage	Mine			sfgpirmr---h---	7	0	1	2	0	0	1	1	12	110377358	1103773585
Raw Material Production Storage	NBC			sfgpirn---h---	7	0	1	0	2	0	1	1	12	110377358	1103773585
Raw Material Production Storage		Biological		sfgpirnb--h---	8	0	1	0	2	1	1	2	15	137971698	1379716981
Raw Material Production Storage		Chemical		sfgpirnc--h---	8	0	1	0	2	1	1	2	15	137971698	1379716981

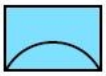
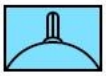
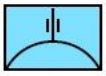
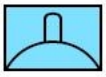
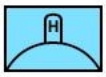
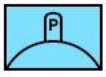
Raw Material Production Storage		Nuclear		sfgpirnn--h---	8	0	1	0	2	1	1	2	15	137971698	1379716981
Raw Material Production Storage	Petroleum Gas Oil			sfgpirp---h---	5	0	0	1	0	0	1	1	8	0.73584906	0.735849057
Service Research Utility Facility				sfgpiu----h---	7	0	0	0	0	4	1	2	14	128773585	1287735849
Service Research Utility Facility	Electric Power Facility			sfgpiue---h---	4	0	0	0	0	0	1	1	6	0.55188679	0.551886792
Service Research Utility Facility	Electric Power Facility	Dam		sfgpiued--h---	5	0	0	0	0	1	1	1	8	0.73584906	0.735849057
Service Research Utility Facility	Electric Power Facility	Fossil Fuel		sfgpiuef--h---	5	0	0	0	0	1	1	2	9	0.82783019	0.827830189
Service Research Utility Facility	Electric Power Facility	Nuclear Plant		sfgpiuen--h---	5	0	0	0	0	1	1	2	9	0.82783019	0.827830189

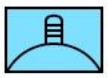
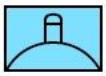
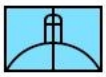
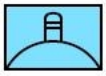
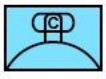
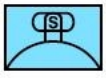
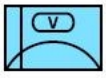
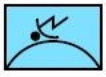
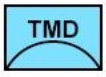
Service Research Utility Facility	Public Water Services			sfgpiup---h---	7	0	0	3	1	0	1	2	14	1.28773585	1.287735849
Service Research Utility Facility	Technological Research Facility			sfgpiur---h---	6	0	0	0	0	3	1	2	12	1.10377358	1.103773585
Service Research Utility Facility	Telecommunications Facility			sfgpiut---h---	6	0	0	3	0	0	1	2	12	1.10377358	1.103773585
Transport Facility				sfgpit----h---	4	0	0	0	0	0	1	1	6	0.55188679	0.551886792
				Mean	6.10256	0	0.282051	0.64103	0.41	0.92308	1	1.51282051	10.87179487		
				Std. Dev.	1.50079	0	0.60475	1.13525	0.79	1.51109	0	0.50636968	3.434955659		

APPENDIX C

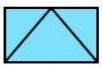
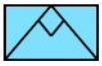
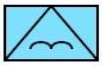
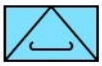
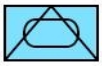
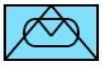
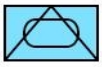
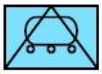
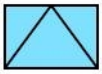
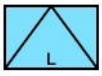
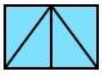
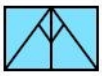
GROUND COMBAT UNIT DATA

Air Defense Unit Data Spreadsheets

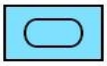
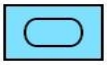
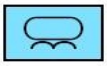
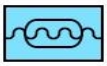
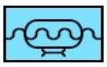
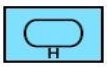
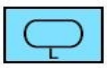
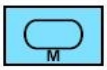
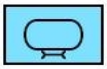
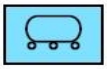
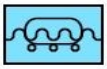
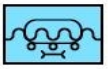
Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
Air Defense				sfgpucd	3	0	0	0	1	0	0	1	5	0.37445	0.40902
Composite				sfgpucdc	8	0	0	3	3	0	0	1	15	1.12335	1.22706
Gun Unit				sfgpucdg	6	0	0	3	1	0	0	1	11	0.82379	0.89985
Missile				sfgpucdm	6	0	0	2	2	0	0	1	11	0.82379	0.89985
Missile	HMAD			sfgpucdh	6	0	0	0	1	3	0	2	12	0.89868	0.98165
Missile	HMAD	Hawk		sfgpucdhh	7	0	0	2	2	1	0	1	13	0.97357	1.06346
Missile	HMAD	Patriot		sfgpucdhp	7	0	0	2	2	1	0	2	14	1.04846	1.14526

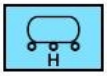
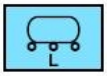
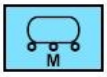
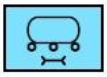
Missile	Heavy			sfgpucdmh	9	0	0	5	2	0	0	1	17	1.27313	1.39067
Missile	Light			sfgpucdml	7	0	0	3	2	0	0	1	13	0.97357	1.06346
Missile	Light	Motorized (Avenger)		sfgpucdmla	8	0	3	4	2	0	0	1	18	1.34802	1.47248
Missile	Medium			sfgpucdmm	8	0	0	4	2	0	0	1	15	1.12335	1.22706
Short Range				sfgpucds	6	0	0	0	1	3	0	2	12	0.89868	0.98165
Short Range	Chapparral			sfgpucdsc	8	0	0	2	2	1	0	2	15	1.12335	1.22706
Short Range	Stinger			sfgpucdss	8	0	2	2	2	1	0	2	17	1.27313	1.39067
Short Range	Vulcan			sfgpucdsv	6	0	1	1	1	1	0	2	12	0.89868	0.98165
Targeting Unit				sfgpucdt	8	0	0	3	2	0	0	2	15	1.12335	1.22706
Theater Missile Defense Unit				sfgpucdo	6	0	0	0	1	3	0	2	12	0.89868	0.98165
				Mean	6.882353	0	0.352941	2.11765	1.71	0.82352941	0	1.4705882	13.3529412		
				Std. Dev.	1.409005	0	0.86177	1.53632	0.59	1.13111085	0	0.5144958	3.04017221		

Anti-Armor Unit Data Spreadsheets

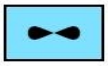
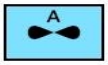
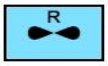
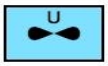
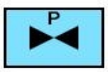
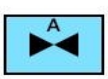
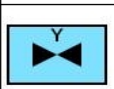
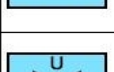
Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
Anti Armor				sfgpucaa	4	0	0	2	0	0	0	1	7	0.62329	0.57263
Air Assault				sfgpucaas	6	0	0	4	0	0	0	1	11	0.97945	0.899847
Airborne				sfgpucaam	6	0	0	2	0	0	0	1	9	0.80137	0.736238
Arctic				sfgpucaac	7	1	0	3	0	0	0	1	12	1.06849	0.981651
Armored				sfgpucaaa	5	0	4	2	0	0	0	1	12	1.06849	0.981651
Armored	Air Assault			sfgpucaaas	7	0	4	4	0	0	0	1	16	1.42466	1.308868
Armored	Tracked			sfgpucaaat	5	0	4	2	0	0	0	1	12	1.06849	0.981651
Armored	Wheeled			sfgpucaaaw	8	4	4	2	0	0	0	1	19	1.69178	1.554281
Dismounted				sfgpucaaad	4	0	0	2	0	0	0	1	7	0.62329	0.57263
Light				sfgpucaal	5	0	0	2	0	1	0	2	10	0.89041	0.818043
Motorized				sfgpucaao	5	0	0	3	0	0	0	1	9	0.80137	0.736238
Motorized	Air Assault			sfgpucaaos	7	0	1	5	0	0	0	1	14	1.24658	1.14526
Mountain				sfgpucaau	5	0	0	2	0	0	0	1	8	0.71233	0.654434
				Mean	5.6923077	0.38462	1.3076923	2.692308	0	0.076923	0	1.0769231	11.23076923		
				Std. Dev.	1.2506409	1.1209	1.8878831	1.031553	0	0.27735	0	0.2773501	3.539158237		

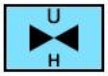
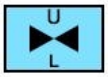
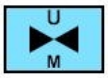
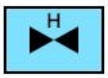
Armor Unit Data Spreadsheets

Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
				sfgpuca	3	0	0	0	0	0	0	0	3	0.24545	0.2454
Track				sfgpucat	3	0	0	0	0	0	0	0	3	0.24545	0.2454
Track	Airborne			sfgpucata	5	0	0	0	2	0	0	1	8	0.65455	0.6544
Track	Amphibious			sfgpucatw	11	0	2	0	8	0	0	1	22	1.8	1.7997
Track	Amphibious	Recovery		sfgpucatwr	14	0	2	1	10	0	0	1	28	2.29091	2.2905
Track	Heavy			sfgpucath	4	0	0	0	0	1	0	1	6	0.49091	0.4908
Track	Light			sfgpucatl	4	0	0	0	0	1	0	2	7	0.57273	0.5726
Track	Medium			sfgpucatm	4	0	0	0	0	0	0	1	5	0.40909	0.409
Track	Recovery			sfgpucatr	6	0	0	1	2	0	0	1	10	0.81818	0.818
Wheeled				sfgpucaw	6	0	0	0	0	0	0	1	7	0.57273	0.5726
Wheeled	Air Assault			sfgpucaws	8	0	2	2	0	0	0	1	13	1.06364	1.0635
Wheeled	Airborne			sfgpucawa	8	0	0	0	2	0	0	1	11	0.9	0.8998
Wheeled	Amphibious			sfgpucaww	14	0	2	0	8	0	0	1	25	2.04545	2.0451
Wheeled	Amphibious	Recovery		sfgpucawwr	17	0	2	1	10	0	0	1	31	2.53636	2.5359

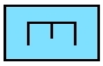
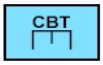
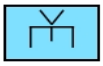
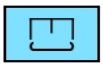
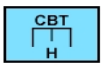
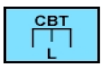
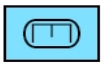
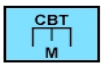
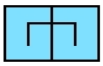
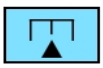
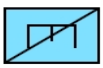
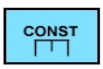
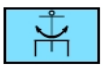
Wheeled	Heavy			sfgpucawh	7	0	0	0	0	1	0	1	9	0.73636	0.7362
Wheeled	Light			sfgpucawl	7	0	0	0	0	1	0	2	10	0.81818	0.818
Wheeled	Medium			sfgpucawm	7	0	0	0	0	1	0	1	9	0.73636	0.7362
Wheeled	Recovery			sfgpucawr	9	0	0	1	2	0	0	1	13	1.06364	1.0635
				Mean	7.611111	0	0.555556	0.3333	2.44	0.2777778	0	1	12.222222		
				Std. Dev.	4.045897	0	0.921777	0.5941	3.73	0.4608886	0	0.485071	8.4960583		

Aviation Unit Data Spreadsheets

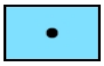
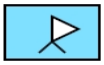
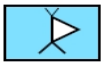
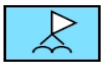
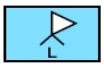
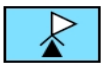
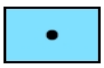
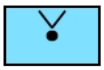
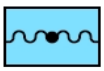
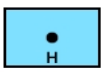
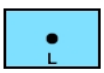
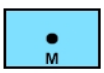
Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
				sfgpucv	4	0	0	0	0	0	0	0	4	0.5116	0.32722
Composite				sfgpucvc	6	0	0	0	0	0	0	0	6	0.7674	0.49083
Fixed Wing				sfgpucvf	4	0	0	0	0	0	0	0	4	0.5116	0.32722
Fixed Wing	Attack			sfgpucvfa	5	0	0	0	0	1	0	1	7	0.8953	0.57263
Fixed Wing	Recon			sfgpucvfr	5	0	0	0	0	1	0	1	7	0.8953	0.57263
Fixed Wing	Utility			sfgpucvfu	5	0	0	0	0	1	0	1	7	0.8953	0.57263
Rotary Wing				sfgpucvr	5	0	0	1	0	0	0	1	7	0.8953	0.57263
Rotary Wing	Anti-submarine Warfare			sfgpucvrw	5	0	0	0	0	1	0	2	8	1.0233	0.65443
Rotary Wing	Attack			sfgpucvra	5	0	0	0	0	1	0	1	7	0.8953	0.57263
Rotary Wing	C2			sfgpucvruc	5	0	0	0	0	1	0	1	7	0.8953	0.57263
Rotary Wing	MED-EVAC			sfgpucvrue	5	0	0	0	0	0	0	1	6	0.7674	0.49083
Rotary Wing	Mine Counter-measures			sfgpucvrm	7	0	0	0	0	3	0	2	12	1.5349	0.98165
Rotary Wing	Scout			sfgpucvrs	5	0	0	0	0	1	0	2	8	1.0233	0.65443
Rotary Wing	Utility			sfgpucvru	5	0	0	0	0	1	0	1	7	0.8953	0.57263

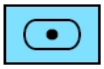
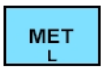
Rotary Wing	Utility	Heavy		sfgpucvruh	6	0	0	0	0	2	0	1	9	1.1512	0.73624
Rotary Wing	Utility	Light		sfgpucvrul	6	0	0	0	0	2	0	2	10	1.2791	0.81804
Rotary Wing	Utility	Medium		sfgpucvrum	6	0	0	0	0	2	0	1	9	1.1512	0.73624
Search and Rescue				sfgpucvs	5	0	0	0	0	1	0	1	7	0.8953	0.57263
Unmanned Aerial Vehicle				sfgpucvu	4	0	0	2	0	0	0	1	7	0.8953	0.57263
Unmanned Aerial Vehicle	Fixed Wing			sfgpucvuf	6	0	0	2	0	0	0	1	9	1.1512	0.73624
Unmanned Aerial Vehicle	Rotary Wing			sfgpucvur	6	0	0	2	0	0	0	1	9	1.1512	0.73624
Vertical Short Takeoff and Landing				sfgpucvv	9	0	0	0	0	4	0	2	15	1.9186	1.22706
				Mean	5.409091	0	0	0.31818	0	1	0	1.090909	7.8181818		
				Std. Dev.	1.098011	0	0	0.71623	0	1.06904	0	0.610159	2.4031005		

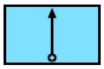
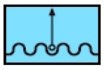
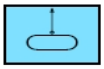
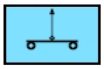
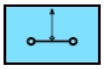
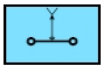
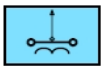
Engineer Unit Data Spreadsheets

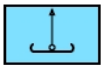
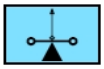
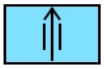
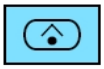
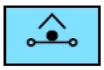
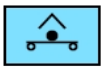
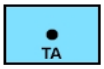
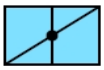
Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
				sfgpuce	6	1	0	4	0	0	0	1	12	0.72103	0.98165
Combat				sfgpucec	9	1	0	4	0	3	0	2	19	1.14163	1.55428
Air Assault				sfgpucecs	8	1	0	6	0	0	0	1	16	0.96137	1.30887
Airborne				sfgpuceca	8	1	0	4	2	0	0	1	16	0.96137	1.30887
Arctic				sfgpucecc	9	2	0	5	2	0	0	1	19	1.14163	1.55428
Heavy				sfgpucech	10	1	0	4	0	4	0	2	21	1.2618	1.71789
Light (Sapper)				sfgpucecl	10	1	0	4	0	4	0	2	21	1.2618	1.71789
Mechanized (Track)				sfgpucect	7	1	0	4	0	0	0	1	13	0.78112	1.06346
Medium				sfgpucecm	10	1	0	4	0	0	0	2	17	1.02146	1.39067
Motorized				sfgpucecw	6	1	1	4	0	0	0	1	13	0.78112	1.06346
Mountain				sfgpuceco	7	1	0	4	0	0	0	1	13	0.78112	1.06346
Recon				sfgpucecr	7	1	2	5	0	0	0	2	17	1.02146	1.39067
Construction				sfgpucen	11	1	0	4	0	5	0	2	23	1.38197	1.8815
Construction	Naval			sfgpucenn	7	1	0	4	0	0	0	1	13	0.78112	1.06346
				Mean	8.214286	1.0714	0.214286	4.28571429	0.29	1.14286	0	1.428571	16.642857		
				Std. Dev.	1.625687	0.2673	0.578934	0.61124985	0.73	1.91581	0	0.513553	3.5649392		

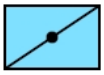
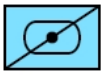
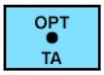
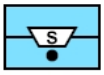
Field Artillery Unit Data Spreadsheets

Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
				sfgpucf	3	0	0	0	0	0	0	0	3	0.27379	0.24541
Artillery Survey				sfgpucfs	6	0	0	2	0	0	0	2	10	0.91262	0.81804
Artillery Survey	Air Assault			sfgpucfss	8	0	0	4	0	0	0	2	14	1.27767	1.14526
Artillery Survey	Airborne			sfgpucfsa	8	0	0	2	2	0	0	2	14	1.27767	1.14526
Artillery Survey	Light			sfgpucfsl	7	0	0	2	0	1	0	2	12	1.09515	0.98165
Artillery Survey	Mountain			sfgpucfso	7	0	0	2	0	0	0	2	11	1.00388	0.89985
Howitzer Gun				sfgpucfh	3	0	0	0	0	0	0	0	3	0.27379	0.24541
Howitzer Gun	Air Assault			sfgpucfhs	5	0	0	2	0	0	0	1	8	0.7301	0.65443
Howitzer Gun	Airborne			sfgpucfha	5	0	0	0	2	0	0	1	8	0.7301	0.65443
Howitzer Gun	Amphibious			sfgpucfhx	11	0	2	0	8	0	0	1	22	2.00777	1.79969
Howitzer Gun	Arctic			sfgpucfhc	6	1	0	1	2	0	0	1	11	1.00388	0.89985
Howitzer Gun	Heavy			sfgpucfhh	4	0	0	0	0	1	0	1	6	0.54757	0.49083
Howitzer Gun	Light			sfgpucfhl	4	0	0	0	0	1	0	2	7	0.63883	0.57263
Howitzer Gun	Medium			sfgpucfhm	4	0	0	0	0	1	0	1	6	0.54757	0.49083

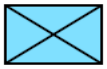
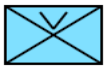
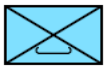
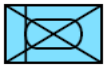
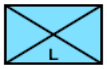
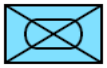
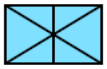
Howitzer Gun	Mountain			sfgpucfho	4	0	0	0	0	0	0	1	5	0.45631	0.40902
Howitzer Gun	Self Propelled			sfgpucfhe	4	0	0	0	0	0	0	0	4	0.36505	0.32722
Meteorological				sfgpucfo	5	0	0	0	0	3	0	2	10	0.91262	0.81804
Meteorological	Air Assault			sfgpucfos	7	0	0	2	0	3	0	2	14	1.27767	1.14526
Meteorological	Airborne			sfgpucfoa	7	0	0	0	2	3	0	2	14	1.27767	1.14526
Meteorological	Light			sfgpucfol	6	0	0	0	0	4	0	2	12	1.09515	0.98165
Meteorological	Mountain			sfgpucfoo	6	0	0	0	0	3	0	2	11	1.00388	0.89985

Mortar				sfgpucfm	4	0	0	1	0	0	0	1	6	0.54757	0.49083
Mortar	Amphibious			sfgpucfml	12	0	0	1	8	0	0	1	22	2.00777	1.79969
Mortar	Self Propelled Tracked			sfgpucfms	5	0	0	1	0	0	0	1	7	0.63883	0.57263
Mortar	Self Propelled Wheeled			sfgpucfmw	7	0	0	2	0	0	0	1	10	0.91262	0.81804
Mortar	Towed			sfgpucfmt	7	0	0	2	0	0	0	1	10	0.91262	0.81804
Mortar	Towed	Air Assault		sfgpucfmts	9	0	0	4	0	0	0	1	14	1.27767	1.14526
Mortar	Towed	Airborne		sfgpucfmta	9	0	0	2	2	0	0	1	14	1.27767	1.14526

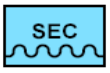
Mortar	Towed	Arctic		sfgpucfmtc	7	1	0	2	2	0	0	1	13	1.18641	1.06346
Mortar	Towed	Mountain		sfgpucfmto	8	0	0	2	0	0	0	1	11	1.00388	0.89985
Rocket				sfgpucfr	5	0	0	2	0	0	0	1	8	0.7301	0.65443
Rocket	Multi Rocket Launcher			sfgpucfrm	7	0	0	4	0	0	0	1	12	1.09515	0.98165
Rocket	Multi Rocket Launcher	Multi Rocket Self Propelled		sfgpucfrms	8	0	0	4	0	0	0	1	13	1.18641	1.06346
Rocket	Multi Rocket Launcher	Multi Rocket Towed		sfgpucfmrt	10	0	0	5	0	0	0	1	16	1.46019	1.30887
Rocket	Multi Rocket Launcher	Multi Rocket Truck		sfgpucfrmr	10	0	0	5	0	0	0	1	16	1.46019	1.30887
Rocket	Single Rocket Launcher			sfgpucfrs	5	0	0	2	0	0	0	1	8	0.7301	0.65443
Rocket	Single Rocket Launcher	Single Rocket Self Propelled		sfgpucfrss	6	0	0	2	0	0	0	1	9	0.82136	0.73624
Rocket	Single Rocket Launcher	Single Rocket Towed		sfgpucfrst	8	0	0	3	0	0	0	1	12	1.09515	0.98165
Rocket	Single Rocket Launcher	Single Rocket Truck		sfgpucfrsr	8	0	0	3	0	0	0	1	12	1.09515	0.98165
Target Acquisition				sfgpucft	5	0	0	0	0	2	0	1	8	0.7301	0.65443
Target Acquisition	ANGLICO			sfgpucfta	7	0	2	1	0	2	0	2	14	1.27767	1.14526
Target Acquisition	COLT FIST			sfgpucfctc	5	0	4	2	0	0	0	2	13	1.18641	1.06346

Target Acquisition	COLT FIST	Dismounted		sfgpucftod	4	0	2	1	0	0	0	2	9	0.82136	0.73624
Target Acquisition	COLT FIST	Tracked		sftpucftcm	5	0	4	1	0	0	0	2	12	1.09515	0.98165
Target Acquisition	Flash (Optical)			sfgpucftf	8	0	0	0	0	5	0	2	15	1.36893	1.22706
Target Acquisition	RADAR			sfgpucftr	7	0	0	3	1	0	0	2	13	1.18641	1.06346
Target Acquisition	Sound			sfgpucfts	8	0	0	2	0	1	0	2	13	1.18641	1.06346
				Mean	6.468085	0.04255	0.297872	1.5745	0.62	0.6383	0	1.3191489	10.957447		
				Std. Dev.	2.073131	0.20403	0.930519	1.4408	1.71	1.24106	0	0.5936762	4.1017358		

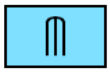
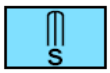
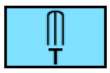
Infantry Unit Data Spreadsheets

Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
				sfgpuci	4	0	0	2	0	0	0	0	6	0.5825243	0.490826
Air Assault				sfgpucis	6	0	0	4	0	0	0	1	11	1.0679612	0.899847
Airborne				sfgpucia	6	0	0	2	2	0	0	1	11	1.0679612	0.899847
Arctic				sfgpucic	7	1	0	3	2	0	0	1	14	1.3592233	1.14526
Infantry Fighting Vehicle				sfgpucii	6	0	0	3	0	0	0	1	10	0.9708738	0.818043
Light				sfgpucil	5	0	0	2	0	1	0	2	10	0.9708738	0.818043
Mechanized				sfgpuciz	5	0	6	2	0	0	0	0	13	1.2621359	1.063456
Motorized				sfgpucim	5	0	0	3	0	0	0	0	8	0.776699	0.654434
Mountian				sfgpucio	5	0	0	2	0	0	0	1	8	0.776699	0.654434
Naval				sfgpucin	5	0	3	2	0	0	0	2	12	1.1650485	0.981651
				Mean	5.4	0.1	0.9	2.5	0.4	0.1	0	0.9	10.3		
				Std. Dev.	0.843274	0.316228	2.02484567	0.707107	0.8433	0.3162278	0	0.737864787	2.45175674		

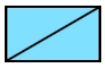
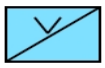
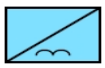
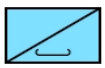
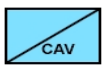
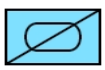
Internal Security Unit Data Spreadsheets

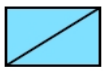
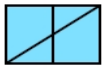
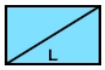
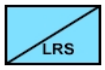
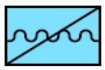
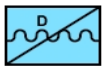
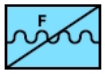
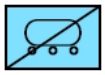
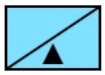
Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
				sfgpucs	5	0	0	0	0	3	0	2	10	0.714286	0.163609
Aviation				sfgpucsa	7	0	0	0	0	3	0	2	12	0.857143	0.163609
Ground				sfgpucsg	5	0	0	0	0	3	0	2	10	0.714286	0.163609
Ground	Dismounted			sfgpucsgd	7	0	4	2	0	3	0	2	18	1.285714	0.163609
Ground	Mechanized			sfgpucsga	6	0	0	0	0	3	0	2	11	0.785714	0.163609
Ground	Motorized			sfgpucsgm	6	0	3	1	0	3	0	2	15	1.071429	0.163609
Ground	Railroad			sfgpucsr	10	0	0	1	0	3	0	2	16	1.142857	0.163609
Ground	Riverine			sfgpucsw	13	0	0	0	0	3	0	2	18	1.285714	0.163609
Ground	Wheeled Mechanized			sfgpucsm	9	0	0	0	0	3	0	2	14	1	0.163609
				Mean	7.55555556	0	0.77777778	0.444444	0	3	0	2	13.77777778		
				Std. Dev.	2.65099562	0	1.56347192	0.726483	0	0	0	0	3.19287401		

Missile Unit Data Spreadsheets

Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
				sfgpucm	6	1	0	3	1	0	0	1	12	0.857143	0.981651
Strategic				sfgpucms	7	1	0	3	1	1	0	2	15	1.071429	1.227064
Tactical				sfgpucmt	7	1	0	3	1	1	0	2	15	1.071429	1.227064
				Mean	6.666666667	1	0	3	1	0.6666667	0	1.66666667	14		
				Std. Dev.	0.577350269	0	0	0	0	0.5773503	0	0.57735027	1.732050808		

Reconnaissance Unit Data Spreadsheets

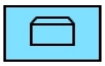
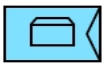
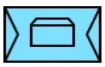
Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
				sfgpucr	3	0	0	1	0	0	0	2	6	0.5025	0.49083
Air Assault				sfgpucrs	5	0	0	3	0	0	0	2	10	0.8374	0.81804
Airborne				sfgpucra	5	0	0	1	2	0	0	2	10	0.8374	0.81804
Arctic				sfgpucrc	6	1	0	2	2	0	0	2	13	1.0887	1.06346
Cavalry				sfgpucrv	6	0	0	1	0	3	0	2	12	1.0049	0.98165
Cavalry	Air			sfgpucrvo	5	0	1	1	0	0	0	2	9	0.7537	0.73624
Cavalry	Armored			sfgpucrva	4	0	2	1	0	0	0	2	9	0.7537	0.73624

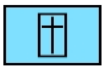
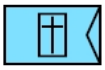
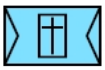
Cavalry	Ground			sfgpucrvg	3	0	0	1	0	0	0	2	6	0.5025	0.49083
Cavalry	Motorized			sfgpucrvm	4	0	1	2	0	0	0	2	9	0.7537	0.73624
Horse				sfgpucrh	3	0	0	0	0	0	0	2	5	0.4187	0.40902
Light				sfgpucrl	4	0	0	1	0	1	0	2	8	0.67	0.65443
Long Range Surveillance				sfgpucrx	6	0	0	1	0	3	0	2	12	1.0049	0.98165
Marine				sfgpucrr	11	0	1	1	8	0	0	2	23	1.9261	1.8815
Marine	Division			sfgpucrrd	12	0	1	1	8	1	0	2	25	2.0936	2.04511
Marine	Force			sfgpucrrf	12	0	1	1	8	1	0	2	25	2.0936	2.04511
Marine	Light Armored Reconnaissance			sfgpucrrl	7	0	4	1	0	0	0	2	14	1.1724	1.14526
Mountain				sfgpucro	4	0	0	1	0	0	0	2	7	0.5862	0.57263
				Mean	5.882353	0.05882	0.6470588	1.17647	1.65	0.52941	0	2	11.941176		
				Std. Dev.	2.997548	0.24254	1.0571883	0.63593	3.1	1.00733	0	0	6.4271941		

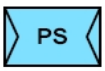
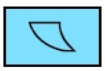
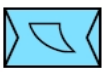
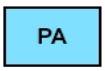
APPENDIX D

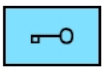
GROUND COMBAT SERVICE SUPPORT UNIT DATA

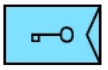
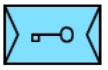
Admin Unit Data Spreadsheets

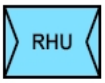
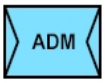
Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
Corps				sfgpusa	5	0	0	0	0	3	0	2	10	0.80435	0.72994
Finance				sfgpusaf	4	0	0	0	0	0	0	1	5	0.40217	0.36497
Finance	Corps			sfgpusafc	6	0	0	2	0	0	0	2	10	0.80435	0.72994
Finance	Theater			sfgpusaft	8	0	0	4	0	0	0	1	13	1.04565	0.94892
JAG				sfgpusaj	5	0	0	0	0	3	0	2	10	0.80435	0.72994
JAG	Corps			sfgusajc	7	0	0	2	0	3	0	2	14	1.12609	1.02191
JAG	Theater			sfgusajt	9	0	0	4	0	3	0	2	18	1.44783	1.31389

MWR				sfgpusaw	5	0	0	0	0	3	0	2	10	0.80435	0.72994
MWR	Corps			sfgpusawc	7	0	0	2	0	3	0	2	14	1.12609	1.02191
MWR	Theater			sfgpusawt	9	0	0	4	0	3	0	2	18	1.44783	1.31389
Mortuary Graves Registration				sfgpusam	4	0	0	0	0	0	0	1	5	0.40217	0.36497
Mortuary Graves Registration	Corps			sfgpusamc	6	0	0	2	0	0	0	2	10	0.80435	0.72994
Mortuary Graves Registration	Theater			sfgpusamt	8	0	0	4	0	0	0	1	13	1.04565	0.94892
Personnel Services				sfgpusas	4	0	0	0	0	2	0	2	8	0.64348	0.58395

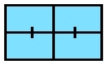
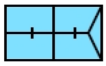
Personnel Services	Corps			sfgpusasc	6	0	0	2	0	2	0	2	12	0.96522	0.87592
Personnel Services	Theater			sfgpusast	10	0	0	4	0	2	0	2	18	1.44783	1.31389
Postal				sfgpusao	3	0	0	0	0	0	0	2	5	0.40217	0.36497
Postal	Corps			sfgpusaoc	5	0	0	2	0	0	0	2	9	0.72391	0.65694
Postal	Theater			sfgpusaot	9	0	0	4	0	0	0	2	15	1.20652	1.0949
Public Affairs				sfgpusap	4	0	0	0	0	2	0	2	8	0.64348	0.58395
Public Affairs	Broadcast			sfgpusapb	6	0	0	0	0	4	0	2	12	0.96522	0.87592

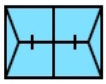
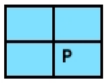
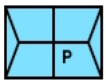
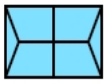
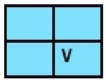
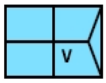
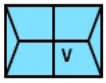
Public Affairs	Broadcast	Corps		sfgpusapbc	8	0	0	2	0	4	0	2	16	1.28696	1.1679
Public Affairs	Broadcast	Theater		sfgpusapbt	10	0	0	4	0	4	0	2	20	1.6087	1.45987
Public Affairs	Joint Information Bureau			sfgpusapm	5	0	0	0	0	3	0	2	10	0.80435	0.72994
Public Affairs	Joint Information Bureau	Corps		sfgpusapmc	7	0	0	2	0	3	0	2	14	1.12609	1.02191
Public Affairs	Joint Information Bureau	Theater		sfgpusapmt	9	0	0	4	0	3	0	2	18	1.44783	1.31389
Public Affairs	Theater			sfgpusapt	8	0	0	4	0	2	0	2	16	1.28696	1.1679
Quartermaster				sfgpusaq	3	0	0	0	0	0	0	2	5	0.40217	0.36497

Quartermaster	Corps			sfgpusaqc	5	0	0	2	0	0	0	2	9	0.72391	0.65694
Quartermaster	Theater			sfgpusaqt	7	0	0	4	0	0	0	2	13	1.04565	0.94892
Religious Chaplain				sfgpusar	5	0	0	0	0	3	0	2	10	0.80435	0.72994
Religious Chaplain	Corps			sfgpusarc	7	0	0	2	0	3	0	2	14	1.12609	1.02191
Religious Chaplain	Theater			sfgpusart	9	0	0	4	0	3	0	2	18	1.44783	1.31389
Replacement Holding Unit				sfgpusax	5	0	0	0	0	3	0	2	10	0.80435	0.72994
Replacement Holding Unit	Corps			sfgpusaxc	7	0	0	2	0	3	0	2	14	1.12609	1.02191

Replacement Holding Unit	Theater			sfgpusaxt	9	0	0	4	0	3	0	2	18	1.44783	1.31389
Theater				sfgpusat	9	0	0	4	0	3	0	2	18	1.44783	1.31389
				Mean	6.567568	0	0	2	0	1.972973	0	1.891892	12.432432		
				Std. Dev.	2.021283	0	0	1.69967	0	1.462237	0	0.3148	4.2527151		

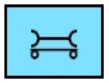
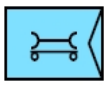
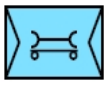
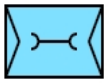
Medical Unit Data Spreadsheets

Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
				sfgpusm	4	0	0	2	0	0	0	0	6	0.43689	0.437962
Corps				sfgpusmc	6	0	0	4	0	0	0	1	11	0.80097	0.80293
Dental				sfgpusmd	5	0	0	2	0	1	0	2	10	0.72816	0.729937
Dental	Corps			sfgpusmdc	7	0	0	4	0	1	0	2	14	1.01942	1.021911
Dental	Theater			sfgpusmdt	9	0	0	6	0	1	0	2	18	1.31068	1.313886
Medical Treatment Facility				sfgpusmm	6	0	2	4	0	0	0	0	12	0.87379	0.875924
Medical Treatment Facility	Corps			sfgpusmmc	8	0	2	6	0	0	0	1	17	1.23786	1.240892

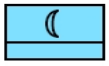
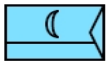
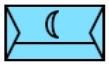
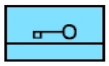
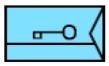
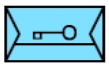
Medical Treatment Facility	Theater			sfgpusmmt	10	0	2	8	0	0	0	0	20	1.45631	1.459873
Psychological				sfgpusmp	5	0	0	2	0	1	0	2	10	0.72816	0.729937
Psychological	Corps			sfgpusmpc	7	0	0	4	0	1	0	2	14	1.01942	1.021911
Psychological	Theater			sfgpusmpt	9	0	0	6	0	1	0	2	18	1.31068	1.313886
Theater				sfgpusmt	8	0	0	6	0	0	0	0	14	1.01942	1.021911
Veterinary				sfgpusmv	5	0	0	2	0	1	0	2	10	0.72816	0.729937
Veterinary	Corps			sfgpusmvc	7	0	0	4	0	1	0	2	14	1.01942	1.021911
Veterinary	Theater			sfgpusmvt	9	0	0	6	0	1	0	2	18	1.31068	1.313886
				Mean	7	0	0.4	4.4	0	0.6	0	1.3333333	13.733333		
				Std. Dev.	1.812654	0	0.828079	1.8822	0	0.507093	0	0.8997354	3.9363991		

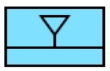
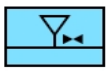
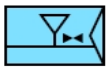
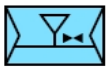
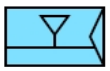
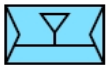
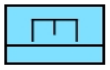
Maintenance Unit Data Spreadsheets

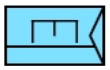
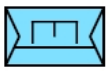
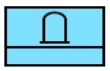
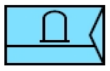
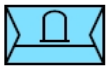
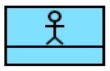
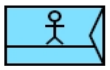
Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
				sfgpusx	5	0	0	1	2	0	0	0	8	0.486486	0.583949
Corps				sfgpusxc	7	0	0	3	2	0	0	1	13	0.790541	0.948918
Electro Optical			EO	sfgpusxe	7	0	0	1	2	2	0	2	14	0.851351	1.021911
Electro Optical	Corps		EO	sfgpusxec	9	0	0	3	2	2	0	2	18	1.094595	1.313886
Electro Optical	Theater		EO	sfgpusxet	11	0	0	5	2	2	0	2	22	1.337838	1.605861
Heavy			H	sfgpusxh	6	0	0	1	2	1	0	1	11	0.668919	0.80293
Heavy	Corps		H	sfgpusxhc	8	0	0	3	2	1	0	2	16	0.972973	1.167899
Heavy	Theater		H	sfgpusxht	10	0	0	5	2	1	0	1	19	1.155405	1.38688
Ordnance				sfgpusxo	6	0	0	1	2	0	0	1	10	0.608108	0.729937
Ordnance	Corps			sfgpusxoc	8	0	0	3	2	0	0	2	15	0.912162	1.094905
Ordnance	Missile			sfgpusxom	9	1	0	4	2	0	0	1	17	1.033784	1.240892
Ordnance	Missile	Corps		sfgpusxomc	11	1	0	6	2	0	0	2	22	1.337838	1.605861
Ordnance	Missile	Theater		sfgpusxomt	13	1	0	8	2	0	0	1	25	1.52027	1.824841
Ordnance	Theater			sfgpsxot	10	0	0	5	2	0	0	1	18	1.094595	1.313886

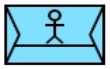
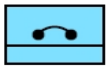
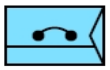
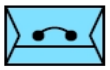
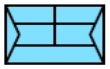
Recovery				sfgpusrr	8	0	0	2	2	0	0	1	13	0.790541	0.948918
Recovery	Corps			sfgpusrrc	10	0	0	4	2	0	0	2	18	1.094595	1.313886
Recovery	Theater			sfgpusrrt	12	0	0	6	2	0	0	1	21	1.277027	1.532867
Theater				sfgpusrt	9	0	0	5	2	0	0	0	16	0.972973	1.167899
				Mean	8.833333	0.1667	0	3.6667	2	0.5	0	1.2777778	16.444444		
				Std. Dev.	2.176073	0.3835	0	2.0292	0	0.785905	0	0.6691132	4.5012707		

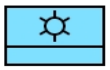
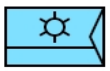
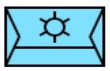
Supply Unit Data Spreadsheets

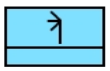
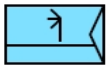
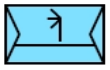
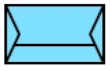
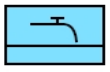
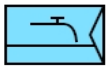
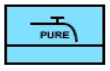
Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
				sfgpuss	3	0	0	1	0	0	0	1	5	0.3814	0.365
Class I				sfgpuss1	4	0	0	1	0	0	0	2	7	0.5339	0.511
Class I	Corps			sfgpuss1c	6	0	0	3	0	0	0	2	11	0.839	0.8029
Class I	Theater			sfgpuss1t	8	0	0	5	0	0	0	2	15	1.1441	1.0949
Class II				sfgpuss2	4	0	0	1	0	0	0	2	7	0.5339	0.511
Class II	Corps			sfgpuss2c	6	0	0	3	0	0	0	2	11	0.839	0.8029
Class II	Theater			sfgpuss2t	8	0	0	5	0	0	0	2	15	1.1441	1.0949

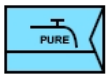
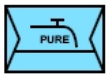
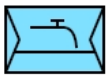
Class III				sfgpuss3	5	0	0	2	0	0	0	1	8	0.6102	0.5839
Class III	Aviation			sfgpuss3a	7	0	0	2	0	0	0	2	11	0.839	0.8029
Class III	Aviation	Corps		sfgpuss3ac	9	0	0	4	0	0	0	2	15	1.1441	1.0949
Class III	Aviation	Theater		sfgpuss3at	11	0	0	6	0	0	0	2	19	1.4492	1.3869
Class III	Corps			sfgpuss3c	7	0	0	4	0	0	0	2	13	0.9915	0.9489
Class III	Theater			sfgpuss3t	9	0	0	6	0	0	0	1	16	1.2203	1.1679
Class IV				sfgpuss4	7	1	0	5	0	0	0	1	14	1.0678	1.0219

Class IV	Corps			sfgpuss4c	9	1	0	7	0	0	0	2	19	1.4492	1.3869
Class IV	Theater			sfgpuss4t	11	1	0	9	0	0	0	1	22	1.678	1.6059
Class V				sfgpuss5	4	0	0	1	0	0	0	1	6	0.4576	0.438
Class V	Corps			sfgpuss5c	6	0	0	3	0	0	0	2	11	0.839	0.8029
Class V	Theater			sfgpuss5t	8	0	0	5	0	0	0	1	14	1.0678	1.0219
Class VI				sfgpuss6	4	0	0	1	0	0	0	1	6	0.4576	0.438
Class VI	Corps			sfgpuss6c	6	0	0	3	0	0	0	2	11	0.839	0.8029

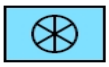
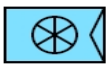
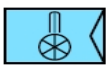
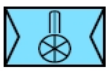
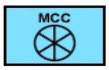
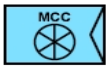
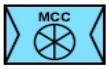
Class VI	Theater			sfgpuss6t	8	0	0	5	0	0	0	1	14	1.0678	1.0219
Class VII				sfgpuss7	6	0	0	1	1	0	0	1	9	0.6864	0.6569
Class VII	Corps			sfgpuss7c	8	0	0	3	1	0	0	2	14	1.0678	1.0219
Class VII	Theater			sfgpuss7t	10	0	0	5	1	0	0	1	17	1.2966	1.2409
Class VIII				sfgpuss8	5	0	0	3	0	0	0	1	9	0.6864	0.6569
Class VIII	Corps			sfgpuss8c	7	0	0	5	0	0	0	2	14	1.0678	1.0219
Class VIII	Theater			sfgpuss8t	9	0	0	7	0	0	0	1	17	1.2966	1.2409

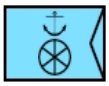
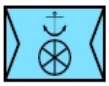
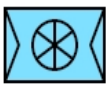
Class IX				sfgpuss9c	4	0	0	1	0	0	0	1	6	0.4576	0.438
Class IX	Corps			sfgpuss9c	6	0	0	3	0	0	0	2	11	0.839	0.8029
Class IX	Theater			sfgpuss9t	8	0	0	5	0	0	0	1	14	1.0678	1.0219
Class X				sfgpussx	5	0	0	1	0	0	0	2	8	0.6102	0.5839
Class X	Corps			sfgpussxc	7	0	0	3	0	0	0	2	12	0.9153	0.8759
Class X	Theater			sfgpussxt	9	0	0	5	0	2	0	2	18	1.3729	1.3139
Corps				sfgpussc	5	0	0	3	0	2	0	2	12	0.9153	0.8759

Laundry Bath				sfgpussl	7	0	0	5	0	2	0	2	16	1.2203	1.1679
Laundry Bath	Corps			sfgpusslc	9	0	0	7	0	0	0	2	18	1.3729	1.3139
Laundry Bath	Theater			sfgpusslt	11	0	0	9	0	0	0	2	22	1.678	1.6059
Theater				sfgpusst	7	0	0	5	0	0	0	1	13	0.9915	0.9489
Water				sfgpussw	4	0	0	1	0	0	0	2	7	0.5339	0.511
Water	Corps			sfgpusswc	6	0	0	3	0	0	0	2	11	0.839	0.8029
Water	Purification			sfgpusswp	8	0	0	1	0	4	0	2	15	1.1441	1.0949

Water	Purification	Corps		sfgpusswpc	10	0	0	3	0	4	0	2	19	1.4492	1.3869
Water	Purification	Theater		sfgpusswpt	12	0	0	5	0	4	0	2	23	1.7542	1.6789
Water	Theater			sfgpusswt	8	0	0	5	0	0	0	2	15	1.1441	1.0949
				Mean	7.1333333	0.06667	0	3.8	0.067	0.4	0	1.6444444	13.1111111		
				Std. Dev.	2.21154	0.25226	0	2.1595	0.252	1.0954451	0	0.4840903	4.5886333		

Transportation Unit Data Spreadsheets

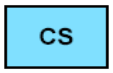
Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
				sfgpust	3	0	0	0	0	0	0	0	3	0.23478	0.21898
APOD APOE				sfgpusta	5	0	1	2	0	0	0	2	10	0.78261	0.72994
APOD APOE	Corps			sfgpustac	7	0	1	4	0	0	0	2	14	1.09565	1.02191
APOD APOE	Theater			sfgpustat	9	0	1	6	0	0	0	2	18	1.4087	1.31389
Corps				sfgpustc	5	0	0	2	0	0	0	2	9	0.70435	0.65694
Missile				sfgpusti	7	1	0	3	1	0	0	1	13	1.01739	0.94892
Missile	Corps			sfgpustic	9	1	0	3	1	0	0	2	16	1.25217	1.1679
Missile	Theater			sfgpustit	11	1	0	7	1	0	0	1	21	1.64348	1.53287
Movement Control Center				sfgpustm	6	0	0	0	0	3	0	2	11	0.86087	0.80293
Movement Control Center	Corps			sfgpustmc	8	0	0	2	0	3	0	2	15	1.17391	1.0949
Movement Control Center	Theater			sfgpustmt	10	0	0	4	0	3	0	1	18	1.4087	1.31389
Railhead				sfgpustr	8	0	0	1	0	0	0	1	10	0.78261	0.72994
Railhead	Corps			sfgpustrc	10	0	0	3	0	0	0	2	15	1.17391	1.0949
Railhead	Theater			sfgpustrt	12	0	0	5	0	0	0	1	18	1.4087	1.31389

SPOD SPOE				sfgpusts	4	0	0	0	0	0	0	1	5	0.3913	0.36497
SPOD SPOE	Corps			sfgpustsc	6	0	0	2	0	0	0	2	10	0.78261	0.72994
SPOD SPOE	Theater			sfgpustst	8	0	0	4	0	0	0	1	13	1.01739	0.94892
Theater				sfgpustt	7	0	0	4	0	0	0	0	11	0.86087	0.80293
				Mean	7.5	0.1667	0.166667	2.88889	0.17	0.5	0	1.388889	12.777778		
				Std. Dev.	2.431412	0.3835	0.383482	1.99673	0.38	1.150447	0	0.697802	4.6722655		

APPENDIX E

GROUND COMBAT SUPPORT UNIT DATA

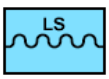
EOD Unit Data Spreadsheets

Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
CS				sfgpuu	4	0	0	0	0	2	0	2	8	0.888889	0.65200471
EOD				sfgpuue	5	0	0	0	0	3	0	2	10	1.111111	0.81500589
				Mean	4.5	0	0	0	0	2.5	0	2	9		
				Std. Dev.	0.70710678	0	0	0	0	0.7071068	0	0	1.414213562		

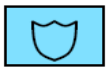
Information Warfare Unit Data Spreadsheets

Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
Information Warfare Unit				sfgpuui	4	0	0	0	0	2	0	2	8	1	0.652005

Landing Support Unit Data Spreadsheets

Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
Landing Support				sfgpuup	12	0	0	0	8	2	0	2	24	1	1.956014

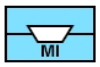
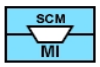
Law Enforcement Unit Data Spreadsheets

Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
				sfgpuul	5	0	0	0	0	2	0	2	9	1.102041	0.733505
Central Intelligence Division				sfgpuuld	5	0	0	0	0	3	0	2	10	1.22449	0.815006
Civilian Law Enforcement				sfgpuulc	3	0	0	0	0	0	0	1	4	0.489796	0.326002
Military Police				sfgpuulm	4	0	0	0	0	2	0	2	8	0.979592	0.652005
Security Police (Air)				sfgpuulf	6	0	0	0	0	2	0	2	10	1.22449	0.815006
Shore Patrol				sfgpuuls	4	0	0	0	0	2	0	2	8	0.979592	0.652005
				Mean	4.5	0	0	0	0	1.8333333	0	1.83333333	8.166666667		
				Std. Dev.	1.04880885	0	0	0	0	0.9831921	0	0.40824829	2.228601953		

Military Intelligence Unit Data Spreadsheets

Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
				sfgpuum	4	0	0	0	0	2	0	2	8	0.5581	0.652
Aerial Exploitation				sfgpuuma	6	0	0	2	0	2	0	2	12	0.8372	0.97801
Counter Intelligence				sfgpuumc	4	0	0	0	0	2	0	2	8	0.5581	0.652
Interrogation				sfgpuumq	5	0	0	0	0	3	0	2	10	0.6977	0.81501
Joint Intelligence Center				sfgpuumj	5	0	0	0	0	3	0	2	10	0.6977	0.81501
Operations				sfgpuumo	7	0	0	0	0	5	0	2	14	0.9767	1.14101
SIGINT				sfgpuums	11	0	0	7	0	2	0	2	22	1.5349	1.79301

SIGINT	Electronic Warfare			sfgpuumse	4	0	0	0	0	2	0	2	8	0.5581	0.652
SIGINT	Electronic Warfare	Armored Wheeled Vehicle		sfgpuumsea	9	0	4	1	0	2	0	2	18	1.2558	1.46701
SIGINT	Electronic Warfare	Corps		sfgpuumsec	6	0	0	2	0	2	0	2	12	0.8372	0.97801
SIGINT	Electronic Warfare	Direction Finding		sfgpuumsed	7	0	0	3	0	2	0	2	14	0.9767	1.14101
SIGINT	Electronic Warfare	Intercept		sfgpuumsei	6	0	0	1	0	2	0	2	11	0.7674	0.89651
SIGINT	Electronic Warfare	Jamming		sfgpuumsej	20	0	0	0	16	2	0	2	40	2.7907	3.26002
SIGINT	Electronic Warfare	Theater		sfgpuumset	8	0	0	4	0	2	0	2	16	1.1163	1.30401

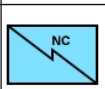
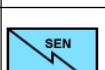
Surveillance				sfgpuumr	4	0	0	0	0	2	0	2	8	0.5581	0.652
Surveillance	Ground Station Module			sfgpuumrx	7	0	0	0	0	5	0	2	14	0.9767	1.14101
Surveillance	Ground Surveillance Radar			sfgpuumrg	8	0	0	3	1	2	0	2	16	1.1163	1.30401
Surveillance	Meteorological			sfgpuummo	7	0	0	0	0	5	0	2	14	0.9767	1.14101
Surveillance	Sensor			sfgpuumrs	8	0	0	2	0	2	0	2	14	0.9767	1.14101
Surveillance	Sensor	SCM		sfgpuumrss	11	0	0	2	0	5	0	2	20	1.3953	1.63001
Tactical Exploit				sfgpuumt	6	0	0	0	0	4	0	2	12	0.8372	0.97801
				Mean	7.285714	0	0.1904762	1.28571	0.81	2.7619	0	2	14.333333		
				Std. Dev.	3.56571	0	0.8728716	1.82052	3.487	1.22085	0	0	7.0521864		

NBC Unit Data Spreadsheets

Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
				sfgpuua	6	0	0	0	2	0	0	2	10	0.64103	0.81501
Biological				sfgpuuab	7	0	0	0	2	1	0	2	12	0.76923	0.97801
Biological	Recon Equipped			sfgpuuabr	9	0	2	2	2	1	0	2	18	1.15385	1.46701
Chemical				sfgpuuac	7	0	0	0	2	1	0	2	12	0.76923	0.97801
Chemical	Recon			sfgpuuacr	8	0	4	1	2	1	0	2	18	1.15385	1.46701
Chemical	Recon	Wheeled Armored Vehicle		sfgpuuacrw	11	0	6	1	2	0	0	2	22	1.41026	1.79301
Chemical	Recon	Wheeled Armored Vehicle Surveillance		sfgpuuacrs	13	0	6	1	2	2	0	2	26	1.66667	2.11902

Chemical	Smoke			sfgpuuacs	7	0	0	0	2	1	0	2	12	0.76923	0.97801
Chemical	Smoke	Armor		sfgpuuacsa	8	0	2	0	2	1	0	2	15	0.96154	1.22251
Chemical	Smoke	Motorized		sfgpuuacsm	8	0	4	1	2	1	0	2	18	1.15385	1.46701
Chemical	Smoke Decon			sfgpuuacc	8	0	0	0	2	2	0	2	14	0.89744	1.14101
Chemical	Smoke Decon	Mechanized		sfgpuuacck	9	0	2	0	2	2	0	2	17	1.08974	1.38551
Chemical	Smoke Decon	Motorized		sfgpuuaccm	9	0	1	0	2	2	0	2	16	1.02564	1.30401
Decontamination				sfgpuuad	7	0	0	0	2	1	0	2	12	0.76923	0.97801
Nuclear				sfgpuuan	7	0	0	0	2	1	0	2	12	0.76923	0.97801
				Mean	8.266667	0	1.8	0.4	2	1.133333	0	2	15.6		
				Std. Dev.	1.791514	0	2.2103652	0.6325	0	0.63994	0	0	4.37198876		

Signal Unit Data Spreadsheets

Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
				sfgpuus	5	0	0	3	0	0	0	2	10	0.58621	0.81501
Area				sfgpuusa	9	0	0	3	0	4	0	2	18	1.05517	1.46701
Command Operation				sfgpuuso	8	0	0	3	0	3	0	2	16	0.93793	1.30401
Communication Configured Package				sfgpuusc	8	0	0	3	0	3	0	2	16	0.93793	1.30401
Communication Configured Package	Large Communication Configured Package			sfgpuuscl	11	0	0	3	2	4	0	2	22	1.28966	1.79301
Electronic Ranging				sfgpuusx	5	0	0	1	0	0	0	2	8	0.46897	0.652
Forward Communications				sfgpuusf	8	0	0	3	0	3	0	2	16	0.93793	1.30401
Multiple Subscriber element				sfgpuusm	8	0	0	3	0	3	0	2	16	0.93793	1.30401
Multiple Subscriber element	Large Extension Node			sfgpuusml	8	0	0	3	0	3	0	2	16	0.93793	1.30401
Multiple Subscriber element	Node Center			sfgpuusmn	7	0	0	3	0	2	0	2	14	0.82069	1.14101
Multiple Subscriber element	Small Extension Node			sfgpuusms	8	0	0	3	0	3	0	2	16	0.93793	1.30401
Radio Unit				sfgpuusr	13	0	0	10	0	0	0	2	25	1.46552	2.03751
Radio Unit	Relay			sfgpuusrw	10	0	1	7	0	0	0	2	20	1.17241	1.63001
Radio Unit	Tactical Satellite			sfgpuusrs	10	0	6	4	1	0	0	2	23	1.34828	1.87451

Radio Unit	Teletype Center			sfgpuusrt	9	0	2	6	0	1	0	2	20	1.17241	1.63001
Signal Support				sfgpuuss	8	0	0	3	0	3	0	2	16	0.93793	1.30401
Telephone Switch				sfgpuusw	8	0	2	5	0	1	0	2	18	1.05517	1.46701
				Mean	8.411765	0	0.647059	3.8824	0.18	1.941176	0	2	17.058824		
				Std. Dev.	1.938389	0	1.538716	2.0881	0.53	1.519481	0	0	4.2642495		

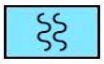
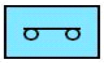
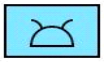
Special C2 Unit Data Spreadsheets

Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
Special C2 Headquarters Component				sfgpuh	3	0	0	0	0	0	0	2	6	6	0.48900353

APPENDIX F

MOOTW AND 2006 – 2007 ADDITIONAL SYMBOL DATA

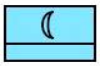
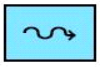
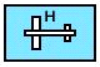
MOOTW Items Symbol Data Spreadsheets

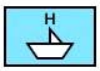
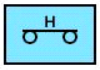
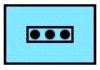
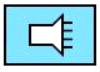
Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
Drug Vehicle				ofipd	9	0	0	1	0	4	0	2	16	12173913	1242852626
Graffiti				ofipg	10	0	0	0	8	0	0	0	18	136956522	1398209205
Internal Security Force				ofipf	5	0	0	0	0	3	0	2	10	0.76086957	0.776782892
Known Insurgent Vehicle				ofipi	5	0	0	1	0	0	0	1	7	0.5326087	0.543748024
Refugees				ofipr	11	0	3	6	0	0	0	1	21	159782609	1631244072
Safe House				ofips	6	0	0	0	0	4	0	2	12	0.91304348	0.93213947
Vandalism Rape Loot Ransack Plunder Sack				ofipv	5	0	0	0	2	0	0	1	8	0.60869565	0.621426313
				Mean	7.285714	0	0.428571	1.14286	1.429	1.571429	0	1.285714	13.14286		
				Std. Dev.	2.627691	0	1.133893	2.19306	2.992	1.98806	0	0.755929	5.304984		

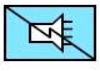
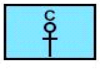
MOOTW Locations Symbol Data Spreadsheets

Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
Black List Location				oflpb	5	0	0	0	0	3	0	2	10	0.754717	0.776782892
Gray List Location				oflpg	6	0	0	0	0	4	0	2	12	0.9056604	0.93213947
Mass Grave Location				oflpm	11	0	3	6	0	0	0	1	21	1.5849057	1.631244072
White List Location				oflpw	5	0	0	0	0	3	0	2	10	0.754717	0.776782892
				Mean	6.75	0	0.75	1.5	0	2.5	0	1.75	13.25		
				Std. Dev.	2.872281323	0	1.5	3	0	1.732051	0	0.5	5.251984375		

MOOTW Operations Symbol Data Spreadsheets

Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
Arrest				ofopa	6	0	1	2	0	0	0	1	10	0.826087	0.776782892
Demonstration				ofopd	6	0	0	0	0	4	0	2	12	0.9913043	0.93213947
Drug Operation				ofopu	6	0	0	0	0	4	0	2	12	0.9913043	0.93213947
Extortion				ofope	5	0	6	2	0	0	0	2	15	1.2391304	1.165174337
Food Distribution				ofopo	5	0	0	1	2	0	0	2	10	0.826087	0.776782892
Foraging Searching				ofopf	7	0	0	2	3	0	0	2	14	1.1565217	1.087496048
Hijacking	Hijack Airplane			ofopha	6	0	2	0	0	1	0	2	11	0.9086957	0.854461181

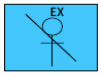
Hijacking	Hijack Boat			ofophv	4	0	0	0	0	1	0	2	7	0.5782609	0.543748024
Hijacking	Hijack Vehicle			ofopht	6	0	0	1	0	1	0	1	9	0.7434783	0.699104602
Kidnapping				ofopk	6	0	1	2	0	1	0	2	12	0.9913043	0.93213947
Mine Laying				ofopm	6	0	0	0	0	0	0	0	6	0.4956522	0.466069735
Patrolling				ofopp	8	0	0	5	0	1	0	2	16	1.3217391	1.242852626
PSYOP				ofopy	7	0	0	4	0	0	0	1	12	0.9913043	0.93213947
PSYOP	House to House Propaganda			ofopyh	8	0	0	4	0	0	0	2	14	1.1565217	1.087496048

PSYOP	TV or Radio Propaganda			ofopyt	10	0	3	7	0	0	0	2	22	1.8173913	1.708922361
PSYOP	Written Propaganda			ofopyw	8	0	0	4	0	1	0	2	15	1.2391304	1.165174337
Recruitment	Coerced Impressed			ofoprc	6	0	1	2	0	1	0	2	12	0.9913043	0.93213947
Recruitment	Willing			ofoprw	6	0	1	2	0	1	0	1	11	0.9086957	0.854461831
Spy				ofops	5	0	0	0	0	3	0	2	10	0.826087	0.776782892
				Mean	6.368421	0	0.7894737	2	0.263	1	0	1.6842105	12.105263		
				Std. Dev.	1.382852	0	1.5121342	2	0.806	1.29099	0	0.5823927	3.5417311		

MOOTW Violent Activities Symbol Data Spreadsheets

Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
Arson Fire				ofvpa	6	0	0	0	0	4	0	2	12	0.92307692	0.93213947
Bomb Bombing				ofvpb	6	0	0	0	0	4	0	2	12	0.92307692	0.93213947
Booby Trap				ofvpy	5	0	0	2	0	0	0	1	8	0.61538462	0.62142633
Drive By Shooting				ofvpd	8	0	0	4	0	0	0	1	13	1	1.00981759
Killing (general)				ofvpm	6	0	2	3	0	0	0	2	13	1	1.00981759
Killing (general)	Assassinatio n			ofvpmc	8	0	2	3	0	2	0	2	17	1.30769231	1.32053091
Killing (general)	Execution			ofvpmb	8	0	2	3	0	2	0	2	17	1.30769231	1.32053091
Killing (general)	M urder			ofvpma	8	0	2	3	0	2	0	2	17	1.30769231	1.32053091
Poisoning				ofvpp	5	0	1	2	0	0	0	1	9	0.69230769	0.69910462
Sniping				ofvps	6	0	0	3	0	1	0	2	12	0.92307692	0.93213947
				M ean	6.6	0	0.9	2.3	0	15	0	17	13		
				Std. Dev.	1.2649111	0	0.9944289	1.3374944	0	1.5811414	0	0.4830459	3.1972210		

2006 Additional Symbol Data Spreadsheets

Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
Assassination				ofvpmc	8	0	3	3	0	2	0	2	18	1054054054	1398209205
Execution				ofvpmb	8	0	3	3	0	2	0	2	18	1054054054	1398209205
Killing (general)				ofvpm	6	0	3	3	0	0	0	2	14	0.81981982	1087496048
Killing (general)	Murder			ofvpma	8	0	3	3	0	2	0	2	18	1054054054	1398209205
Mass Grave				oflpm	11	0	3	6	0	0	0	1	21	122972973	1631244072
Gamg				ofzpf	15	0	3	6	0	4	0	2	30	1756756757	2.330348675
Composite Loss				ofopc	5	0	1	2	0	0	0	1	9	0.527027027	0.699104602

Composite Loss	Combat			ofopca	8	0	1	2	0	3	0	2	16	0.936936937	1242852626
Composite Loss	Accident			ofopcb	8	0	1	2	0	3	0	2	16	0.936936937	1242852626
Composite Loss	Other			ofopcc	8	0	1	2	0	3	0	2	16	0.936936937	1242852626
Kidnapping	Attempted			ofopka	7	0	2	3	0	1	0	2	15	0.878378378	1165174337
Rape				ofrp	7	0	1	2	0	2	0	2	14	0.81981982	1087496048
Rape	Attempted			ofrpa	8	0	2	3	0	2	0	2	17	0.995495495	1320530916
				Mean	8.230769	0	2.076923	3.0769	0	1.846154	0	1.846154	17.07692		
				Std. Dev.	2.454718	0	0.954074	1.3821	0	1.281103	0	0.375534	4.803845		

2007 Additional Symbol Data Spreadsheets

Category	Sub-category 1	Sub-category 2	Symbol	SIDC	Elements	Closure	Continuity	Internal Lines	Arcs	Alpha-numerics	Figural Unity	Symmetry	Complexity Coefficient	Work-sheet Unitized	Spread-sheet Unitized
IED				ofvpyi	5	0	0	0	0	3	0	2	10	1.15384615	0.776782892
Explosion				ofvpe	3	0	0	0	0	0	0	2	5	0.57692308	0.388391446
IED	Explosion			ofvpyie	6	0	0	0	0	3	0	2	11	1.26923077	0.854461831
				Mean	4.66666667	0	0	0	0	2	0	2	8.66666667		
				Std. Dev.	1.52752523	0	0	0	0	1.7320508	0	0	3.21455025		

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